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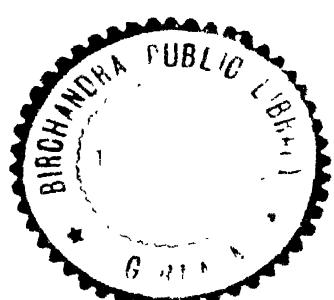
A GOOD SLOGAN IS "MEASURE TWICE AND CUT ONCE

TEACH YOURSELF

CARPENTRY

By

CHARLES HAYWARD



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REMEMBER !

Cheap tools are never cheap.

Spending time in sharpening tools is saving time.

Keep your left hand behind the chisel edge—it can't cut backwards.

Don't force a saw. If it cuts too slowly have it sharpened.

You are more likely to cut yourself using a blunt chisel than a sharp one.

Don't blame the tools when the joint doesn't fit.

If a piece of wood has nails in it it is safer to borrow someone else's saw.

If you drop a chisel don't try to catch it.

Don't pile tools on top of a saw; it costs money to have the latter sharpened.

Stopping may be the woodworker's friend, but he is rather doubtful company in which to be seen.

Cold Scotch glue doesn't stick; it merely congeals.

Veneer may hide shoddy work, but only for a little while.

Don't sharpen your own saws. It is cheaper to pay a professional sharpener.

Keep your tools sharp, even if you do rough work only.

Borrowed tools are nearly always abused. Don't lend yours.

Don't use an oilstone dry; it costs too much to spoil.

The bad workman blames his tools; the good one keeps his sharp.

A job can't be true if the wood is not planed up square.

PREFACE

THE desire to make things is inherent in most of us, and in accordance with our own particular make-up so we begin to make furniture, paint pictures, beat out metal, make model ships, or whatever it may be. Some crafts call for special ability in one direction or another, and if one does not happen to possess it the craft is ruled out entirely. Woodwork is almost unique in this connection, for there are very few people who cannot go in for it. This is partly because anyone, given intelligent application, can learn to work wood successfully, and partly because there are so many branches of woodwork that practically everyone can find one that will appeal to him. Consider for a minute a few of the things that can be made: furniture, toys, garden woodwork, models, carving, general household woodwork, etc. A man's tastes must be very specialised if he cannot find something here to interest him.

There are other reasons, however, why woodwork is the ideal hobby. It is inexpensive, the material being comparatively cheap and the tools not costly (many often already exist in the household chest); it is clean, a wash under the tap after work making one's hands spotless; it can be either light or heavy work, whichever appeals to one; and it is invariably

an economy, for one can make things which would often be costly to buy.

Before one can get the best out of a hobby, however, a certain fundamental knowledge is necessary, and the purpose of this book is to supply this knowledge and to provide suggestions and practical designs for things to make. The opening chapters deal with the choice, care, and use of tools. These are followed by details of the various joints used in woodwork, how they are cut and when used. Finally there is a wide range of things to make, these being divided up under the headings of outdoor woodwork, small things to make, and furniture. It will be seen that in nearly every case a cutting list is provided to assist in ordering materials. The usual allowance of about $\frac{1}{2}$ in. in length and $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in width is made. Thicknesses are net.

Altogether this book should prove ideal for the man who has not had much experience in woodwork and who seeks the essential elementary knowledge which will put him on the right track, and for the rather more advanced woodworker who needs suggestions for things to make and practical designs from which to work.

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Workshop Practice

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CHAPTER VI

Designs for Furniture

are matters which readers can best decide for themselves.

In regard to a bench, many a fine piece of work has been turned out on a kitchen table, but this is

20-in. or 22-in. Handsaw, fine teeth
9-in. or 10-in. Backsaw, fine teeth
14-in. or 16-in. Jack-plane, 2-in. cutter
Wood smoothing-plane, 2⅜-in. cutter
or
Stanley pattern iron smoothing-plane, 2-in. cutter
Rebate-plane, 1¼-in. cutter
Scraper, 5 in.
Chisel (firmer), ¾ in
,, ,, ¼ in
Oilstone, 8 in. by 2 in
Cutting gauge
Brace, 8-in. sweep.
Twist bit, ⅜ in.
Centre bit, ¾ in.
Shell bit, ⅛ in
Countersink, ½ in.
Pincers, 6 in
Hammer, 8-oz. head
Mallet, about 18 oz.
Square, 6 in.
Rule, 2 ft., folding
Screwdriver, 6-in. blade
Bradawl

DETAILS OF THE TOOLS SHOWN ON PAGE 12.

at best only a makeshift. Light benches can normally be obtained, but probably the reader will prefer to make his own. The framework of this should be as heavy as possible to avoid racketing.

Tool Cupboard

It is advisable to have a tool cupboard in the workshop, not only to provide a place for everything, but

also to enable tools to be locked away when not in use. The cupboard shown in Fig. 2 is of handy size for the small workshop and is large enough to hold a fair kit of tools. The sizes should be checked over with the actual tools, however, before a start is made. It may be that the saw or some other tool is extra

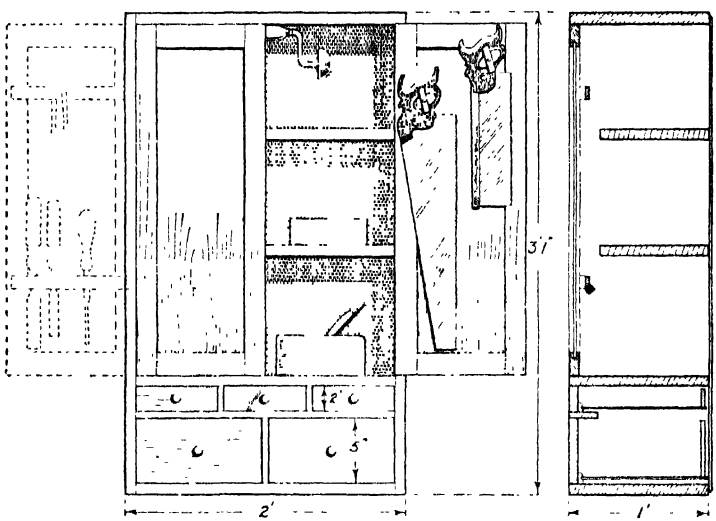


FIG. 2.—USEFUL CUPBOARD FITTED FOR TOOLS.

large and may require an increase in height or width. The larger tools, such as planes, etc., are placed on the shelves behind the doors, and the last named are fitted with racks and clips to hold saws, chisels, screwdrivers, and so on. In this connection, note that the shelves must stand in from the front sufficiently to enable the tools to clear. The top drawers can be fitted with divisions to hold nails,

screws, and small fittings, whilst the larger lower drawers can take the smaller tools which would not hang conveniently behind the doors.

Since the cupboard is intended for the workshop, it can be made of deal and finished with paint or varnish. Fig. 3 shows a simple construction. The

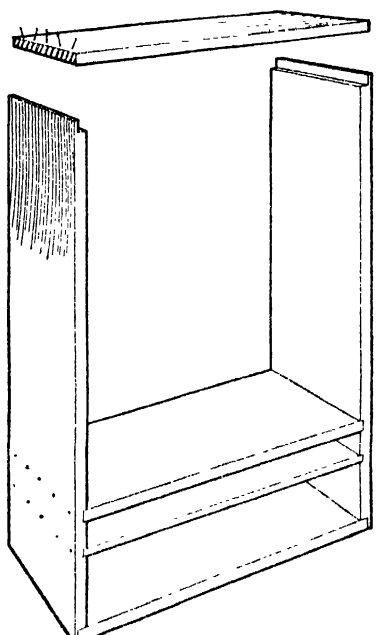


FIG. 3.—CONSTRUCTION OF TOOL CUPBOARD.

top and bottom ends of the sides are rebated to a depth equal to the thickness of the top and bottom. The rebates are cut easily by marking with the gauge, sawing *across* the grain, and chopping out the waste *with* the grain. To hold the drawer divisions grooves are cut across. Here again the saw is used to cut

across the grain. The chisel removes the waste, and if a router is available, this is used to make the groove of equal depth throughout.

When cutting the top, bottom, and drawer divisions to length, allowance must be made for the joints. For instance the length of the top equals the over-all width less the thickness of the two laps at the rebates. The whole thing is put together with glue and nails, and the last named are dovetailed, that is, driven in at an angle in alternate directions. The nails should be punched in and the holes filled in with plastic wood. Test for squareness, and nail on the back a sheet of plywood.

The doors are put together with mortise and tenon joints, the plywood panels preferably fitting in grooves. The chapter on door-making describes the procedure, and gives alternative methods of construction. The tool racks are simply lengths of wood screwed to the inside with little blocks between to bring them well clear of the doors, so allowing plenty of room for the tools. For the saws, shaped pieces to fit in the handles are screwed on (they can be screwed through the plywood from the front) and turn-buttons of wood screwed to these. Fig. 2 shows the idea. The shelves rest on fillets screwed to the cupboard sides.

The drawers can be either dovetailed or put together with lapped joints. For the method of making them see the chapter on drawer making.

CUTTING LIST

	Length.	Width.	Thickness.
2 Sides	3 ft. 1½ in.	12¼ in.	⅞ in.
Top, bottom, division, 3 Pieces	2 ft.	12¼ in.	⅞ in.
1 Division	2 ft.	2¾ in.	½ in.
2 Shelves	1 ft. 10½ in.	9½ in.	⅞ in.
2 Uprights	3 in	2¾ in.	½ in.
1 Upright	6 in.	2¾ in.	½ in.
1 Back	3 ft 1 in.	24 in.	3/16 in. (Ply).
4 Stiles	2 ft. 4 in.	2¼ in.	⅞ in.
4 Rails	11 in.	2¼ in.	⅞ in.
2 Panels	2 ft ½ in.	8½ in.	3/16 in. (Ply).
3 Fronts	7¼ in	2⅛ in.	⅞ in
6 Sides	1 ft.	2⅛ in.	⅜ in.
3 Backs	1 ft.	2 in.	⅜ in.
3 Bottoms	7 in	11 in.	3/16 in. (Ply).
2 Fronts	11 in	5⅛ in	⅞ in.
4 Sides	1 ft.	5⅛ in.	⅜ in.
2 Backs	11 in.	5 in.	⅜ in.
2 Bottoms	11 in.	11 in.	3/16 in. (Ply).

Small parts are extra.

§2. VARIOUS KINDS OF SAWS

The Handsaw

The handsaw is used for cutting up larger pieces of wood, and for general work a length of 20 in. or 22 in. is recommended. If only heavy carpentry is intended, a still larger saw could be chosen, but this is rather cumbersome for cabinet work. It should have fairly fine teeth, so that it can be used for both cross-cutting and ripping.

The tooth size is reckoned at so many to the inch, this being the actual number of points in an inch, including those at both ends. Ten points to the inch is a good all-round size.

When first obtained it will be ready for immediate use, and a feature to note is that not only are the

teeth sharp so far as the points are concerned, but that it has "set," which means that the teeth are bent over slightly in alternate directions. The reason for this is that the saw thus clears itself in the cut or kerf it makes, since the latter is wider than the

FIG. 4.—STARTING THE CUT.

Note how the thumb of the left hand bears against the blade to steady it.

FIG. 5.—HOW CUT IS FINISHED.

The left hand supports the overhanging piece to prevent the grain from splintering.

thickness of the blade. If there were no set, the saw would bind in the kerf after the first few cuts and would be difficult to use.

Nails in the wood should be avoided at all costs. A single jar on a nail is enough to take off the edge—in bad cases it may break a tooth off. Do not attempt

to sharpen it yourself unless you have had experience. It is seldom an economy, because, if the teeth become uneven through faulty filing, a professional sharpener will charge more to put it right. Better by far to take it to a reliable sharpener as soon as it becomes dull.

A saw should never be forced. Keep it moving steadily for nearly its full length. Its own weight plus the slightest pressure is all that is needed. To start the cut, place the thumb of the left hand against the blade, as in Fig. 4. This steadies the blade, enabling it to start in the right place, and prevents an accident in the event of the saw jumping. Make one or two short movements, taking care that the saw works in the right direction, and then give full, easy strokes. When the end is reached, the left hand can hold the overhanging piece as in Fig 5, to prevent it from breaking off and so splitting. Note that the index finger of the right hand points along the handle. This gives positive control.

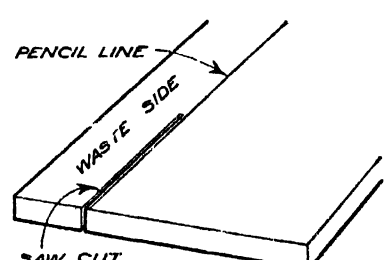


FIG. 6.—SAWING TO PENCIL LINE. The cut is made on the waste side.

A point to note in all sawing is that, as a rule, the cut is made to one side of the line. The latter represents the finished size of the wood, and if the saw were taken directly along it, the wood would be too small. The cut is therefore made on the waste side, as in Fig. 6, so that the wood can afterwards be trimmed with the plane.

The Backsaw

When one saw only is being used a length of 9 in. or 10 in. is useful, though the ideal is to have a 14-in. tenon-saw for heavy cutting, and an 8-in. dovetail-saw for fine joints.

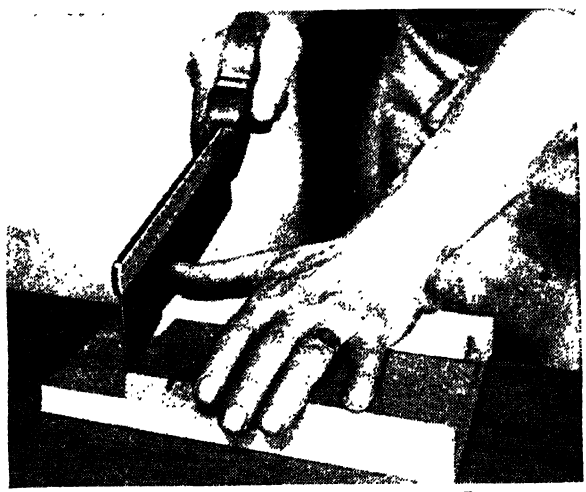


FIG. 7.—USING BENCH HOOK WHEN SAWING.
The purpose of this is to steady the wood. Note how the left-hand thumb bears against the blade of the saw.

Fig. 7 shows the saw in use, and it will be seen that the wood is held on what is known as a bench hook. This steadies it, and is easily made from odd scraps, as shown in Fig. 8. One point to note is that the strip which bears against the edge of the bench should be fixed on with dowels rather than nails or screws. It is inevitable that with continuous use the

wood will gradually be sawn away, and this may result in the nails becoming bared, so jarring the saw.

For the tenon-saw choose one with about twelve or fourteen points to the inch. If, however, only the one 10-in. saw is being bought, it should have teeth

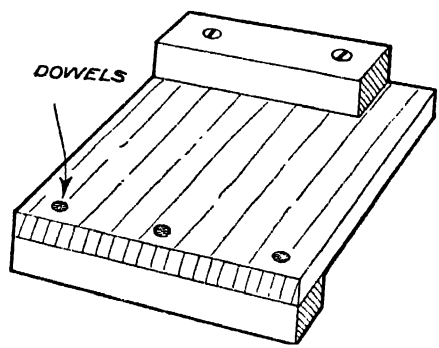


FIG. 8.—DETAILS OF BENCH HOOK.

not larger than fourteen to the inch. A dovetail saw could have twenty or twenty-two points.

Saws for Cutting Shapes

Although these are not included in the list of preliminary tools, the serious wood-worker will need them if he has any shaped work to do. The bowsaw is the most useful, since the blade is under constant tension. It is shown in use in Fig. 9. It is gripped with both hands, the wood being held steady in the vice. The handles to which the blade is attached are free to turn, so that the saw can be used to cut in a direction parallel to the edge. Otherwise its use would be limited by the depth of the blade from the

cross-bar. When cutting interior holes the rivet is knocked out at one handle, thus freeing the blade. The latter can then be passed through a hole drilled in the wood, and the rivet replaced.

There is, of course, a limit to the distance from the edge at which this saw can cut, and when its use

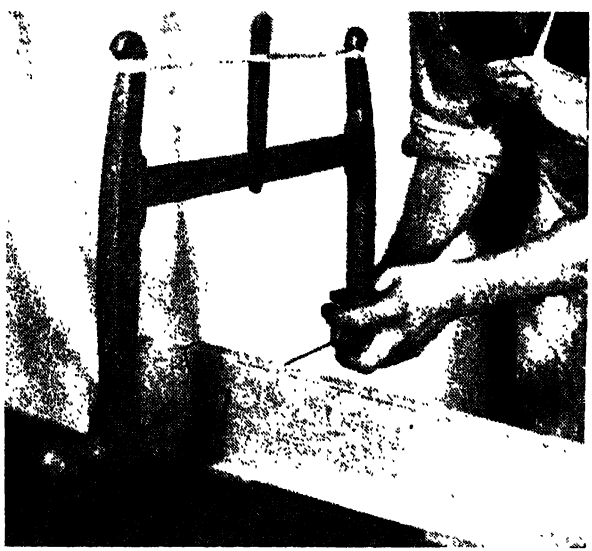


FIG. 9.—HOW BOWSAW IS USED.
Note that the blade is turned to enable it to cut horizontally.

is impracticable the keyhole-saw is needed. It is shown in Fig. 10. Note that the blade can be made to slide into the handle, and the general rule is to have out only as much blade as is necessary for the work, because the saw buckles so easily.

A handy tool for the model-maker is the fretsaw. Thin wood and small work can be cut satisfactorily

only with this. It is used in conjunction with the special V cutting-board sold for the purpose.

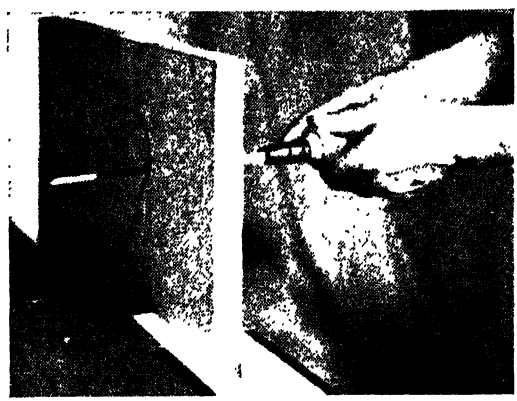


FIG. 10.—CUTTING WITH KEYHOLE-SAW.
This is used mainly for interior cuts well in from the edge.

§3. USE OF THE PLANE

The Jack-plane

This is the " maid-of-all-work " plane. It can be set coarse, so enabling the thickness of a piece of wood to be reduced quickly, and its length prevents it from digging in and producing an uneven surface. The professional woodworker generally reserves it for the rougher sort of work, since he has a long trying-plane, with which to shoot joints and true-up a surface. This, of course, is the better plan, but probably few amateurs would care to go to the expense of a trying-plane, and this means that all trueing-up must be done with the jack-plane.

The Cutting Action

It is desirable to understand how a plane works if one is to turn out good work. First of all there is the question of its length. A smoothing-plane is liable to dig into the wood, producing a curve which runs through points located at the front and back of the plane and through the cutter at the centre. It is obvious that the farther apart the front and back the less the plane can dig in. Hence the necessity for a long plane when long surfaces are to be trued up.

The back iron plays an important part. Its purpose is to break the shaving, so robbing it of its strength, and thus largely preventing it from splitting out. If there were no back-iron, the actual edge of the cutter would not be making the cut, because the shaving would be levered up, with the result that it would be torn up, so leaving corresponding tears on the surface of the wood. By fitting a back-iron, the shaving is broken almost as soon as it is raised, and is not so liable to tear out. The closer the back-iron is to the edge, the less liable it is to tear out the wood; but, on the other hand, the resistance is increased considerably. For normal work a compromise is effected, fitting the back-iron about $\frac{1}{16}$ in. from the edge. When a piece of wood with difficult grain has to be planed, the back-iron is advanced and the plane set as fine as possible.

The mouth, too, has to be considered. When small it prevents the shaving from being raised too soon, and thus helps to prevent tearing out. There is a limit to the size, however, since too fine a mouth

may cause choking, especially in a jack-plane, which may have to remove fairly thick shavings.

Sharpening the Plane

To sharpen the plane remove the cutter and wedge by striking the striking-button, and undo the

FIG. 11.—SHARPENING THE PLANE-IRON.
The correct angle is from 30 to 35 degrees.

screw holding the back-iron. The latter can then be slid off. Put a few drops of oil on the stone and place the cutter on the latter so that the ground bevel lies flat. Now, raising the hands *slightly* so that just the edge of the cutter is touching the stone, work back and forth as shown in Fig. 11. This will turn up a burr at the back, which can be detected by drawing the

thumb *across* the edge at the back. This is an indication that it is sharp, and the burr is removed by reversing the cutter *flat* on the stone and moving back and forth once or twice as shown in Fig. 12. It is then stropped either on a piece of leather glued

FIG. 12.—REMOVING BURR FROM THE PLANE-IRON.
It is essential that the iron is kept flat.

to a flat board, or by drawing it *across* the left hand, first one side and then the other (Fig. 13). It should be noted that it is of the utmost importance that the back is not dubbed over either on the stone or on the leather strop.

Drawing the thumb across the edge is an indication whether or not it is sharp, but it does not show whether a gash, such as might be caused by a nail,

is taken out. This is best ascertained by holding the cutter to the light. A sharp edge cannot be seen, whereas a dull one will show as a thin line of light. Similarly, any gashes will show up light. It is then a case of rubbing down until the whole edge is sharp.

The cutting edge of a jack-plane iron should be

FIG. 13.—STROPPING THE CUTTER.
It is drawn *across* the hand, first one side and then the other.

slightly rounded so that when used on a board the shavings taper away to nothing at the sides. The roundness must not be overdone, as this will cause bad hollows in the surface. In fact, when required for close trueing-up it should be almost straight, with just the corners taken off to prevent them from digging in.

The back-iron is now replaced, and the two are put in the plane and held by the thumb of the left

hand. By placing the plane over a sheet of paper and holding it in line with the eye, as in Fig. 14, the

FIG. 14.—SETTING THE PLANE.
The plane rests upon a sheet of white paper so that the line of the cutter shows up clearly.

projection of the cutter can be seen. It should appear as a thin black line. The wedge can then be knocked in and a final sight taken. More projection

can be given by tapping the back of the cutter; less by tapping lightly the striking button.

Fig. 15 shows how the plane is used on broad surfaces. The left hand grasps the top. The

FIG. 15.—USING PLANE ON A BROAD SURFACE.
The left hand bears down on top of the plane.

important parts are the beginning and ending of the stroke. Dubbing over must be avoided at all costs. At the start exert plenty of downward pressure at the front, and as the far end is reached change over the pressure to the back. This is shown clearly in Fig. 16.

FIG. 16.—WHERE PRESSURE IS APPLIED WHEN PLANING.

The left hand should be held as in Fig. 17 when planing an edge, the fingers touching the side of the wood, and so acting as a sort of gauge or fence. The simplest way of shooting an edge straight is to set the plane fine and remove as much wood as possible from the centre until the plane will cut no more. One or two shavings along the whole length will then

FIG. 17.—HOLDING PLANE WHEN PLANING AN EDGE.
Note how fingers of left hand pass under the sole and bear against the wood to act as a sort of fence.

produce a straight edge, providing the plane is true and the wood not too long. For a start, however, it is advisable to test with a straight-edge—also with a square to see that it is at right angles with the sides.

To prevent the grain from splitting out when planing end grain the far corner can be chiselled off

as at *B*, Fig. 18, or by temporarily cramping on a block of wood as at *C*. The block supports the corner.

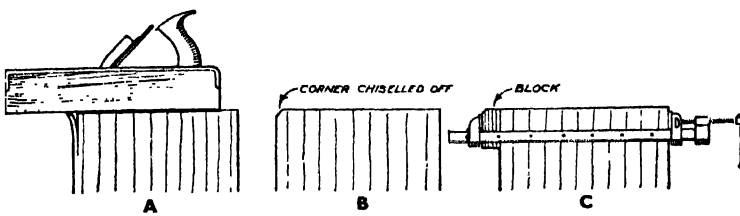


FIG. 18.—POINTS TO NOTE WHEN PLANING END GRAIN.
A. How far corner is liable to split out.
B, C. Methods of avoiding the splitting.

A shooting-board is an invaluable appliance, both for planing the edges of thin wood and for trimming the ends square. It is easily made as shown in Fig. 19. The length can be fixed in accordance with

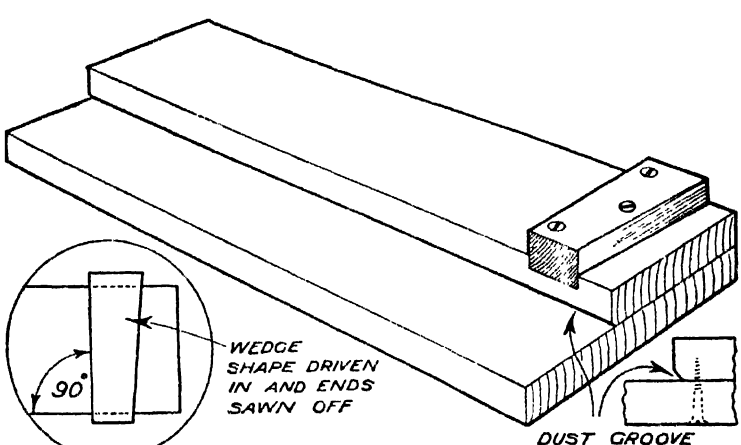


FIG. 19.—SIMPLE SHOOTING-BOARD.
The lower corner of the top piece is slightly bevelled to form a groove for dust.

the usual size of work to be done. It is shown in use in Fig. 20. When two boards are to be jointed, a face mark is made on each. They are then planed, one with the face side uppermost, and the other with the face side downwards. The reason for this is that if the plane works a trifle out of square, the reversing of the second board gives it a precisely

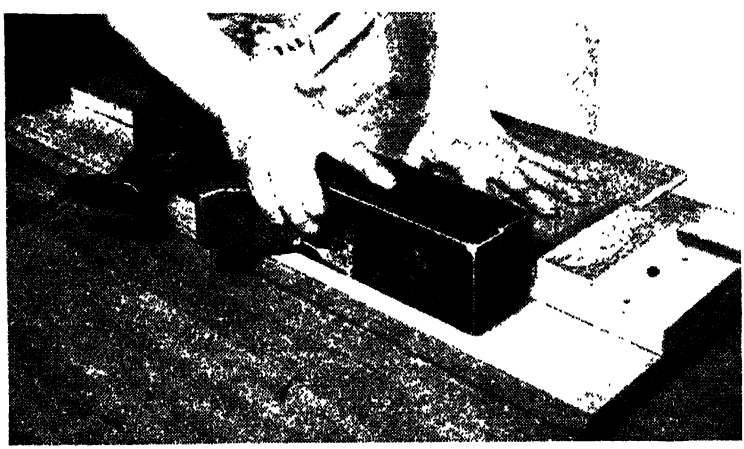


FIG. 20.—PLANING THIN WOOD ON SHOOTING-BOARD.
This ensures the edge being square, since the plane cannot wobble.

opposite angle, and the two go together in perfect alignment.

The Smoothing-Plane

The metal type of smoothing-plane is recommended, though it costs rather more. It is so handy for fine work on the shooting-board and in all work generally. One point to note is that all metal planes require lubricating. A piece of candle rubbed on the sole

occasionally or a wad of cotton wool soaked in linseed oil can be used. As the plane is used for final cleaning up on wide surfaces, the cutter edge should be almost straight, with the corners taken off.

The Rebate-Plane

For some jobs this is essential. It is shown in use in Fig. 21. Note that the fingers of the left hand

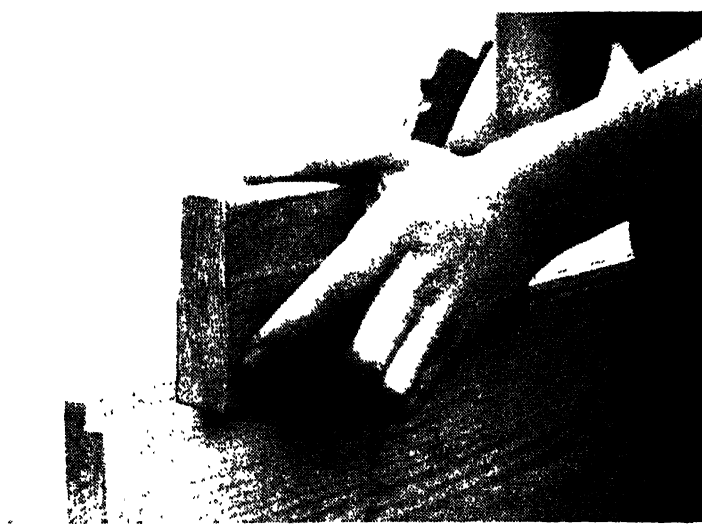


FIG. 21.—THE REBATE-PLANE IN USE.
Note how the fingers of the left hand bear against the wood to act as a sort of fence.

pass beneath the plane and touch the side of the wood, so acting as a fence. Metal rebate-planes are available, and these possess the advantage of having a fence which enables the rebate to be automatically kept parallel with the edge. In any case the width

and depth of the rebate should be marked in first with the gauge.

§4. THE SCRAPER

The scraper is used entirely for cleaning up. A plane, no matter how finely set, is bound to leave a number of " waves," due to the shape of the cutter,

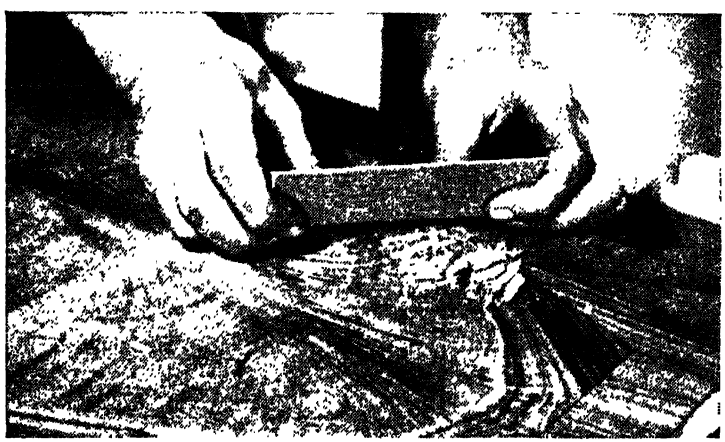


FIG. 22.—HOW SCRAPER IS USED TO CLEAN UP PANEL.
It is held obliquely when working over a cross-banding to reduce risk of tearing out the grain.

and the scraper is used to take out these. Furthermore, some woods have difficult grain, which is liable to tear out even when the back-iron is set close, and the scraper, taking an extremely fine shaving, can be used to take out tears left by the plane. Then, again, for cleaning up veneered surfaces the scraper is essential, since the plane would take too coarse a shaving.

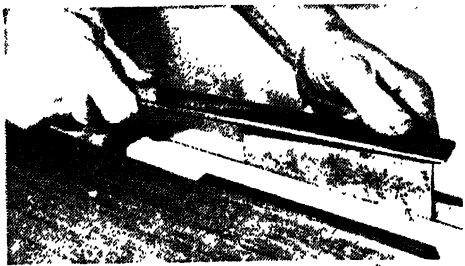
A scraper should be of medium thickness. If too thick, it will require a great deal of exertion to keep bent (a scraper is bent slightly in use by the thumbs as in Fig. 22), which will prove tiring. On the other hand, a thin scraper will rapidly become hot and burn the thumbs. Somewhere in the region of $\frac{3}{16}$ in. is about right.

The cutting edge is obtained by turning up a burr as at *F*, Fig. 23, and to enable this to be done the edges must first be made square and smooth. Fixing the scraper in the vice, rub down each long edge with a flat file as at *A*. This will make it true, but the file-marks must be got rid of by rubbing on the stone. If it is worked on the edge of the stone with the cover opened slightly as at *B*, there will be a good guide for holding it upright. It should be grasped with a piece of rag to prevent an accident. To get rid of the inevitable ragged burr the sides are now rubbed down (*C*), the scraper being held perfectly flat on the stone. Afterwards a few rubs can again be given on the edge.

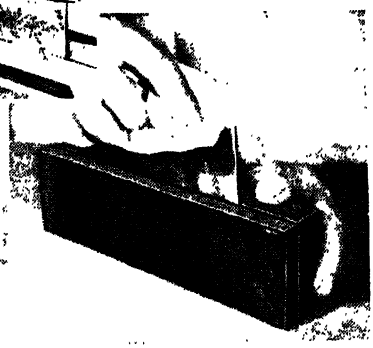
The actual cutting burr is now turned up by using a hard steel instrument such as a gouge. The scraper should be placed on the bench with the edge overhanging about $\frac{1}{4}$ in., and a sharp stroke made with the gouge first in one direction, then in the other as at *E*, the gouge being held a few degrees out of the vertical. If the thumb is drawn *across* the edge, the turned-up burr will be apparent. All four edges are treated in the same way.

After being in use for a time the edges will lose their keenness and will require to be turned again.

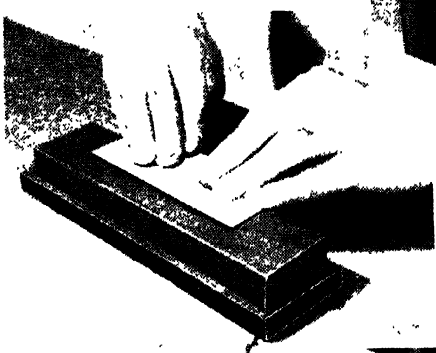
FIG. 23.—STAGES IN SHARPENING THE SCRAPER.



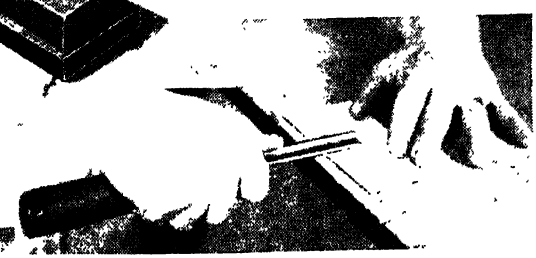
A. Filing the edge.



B. Rubbing edge on the oilstone.

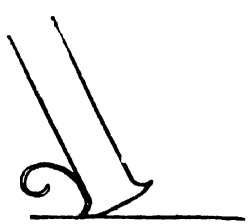


C. Removing the burr.



D. Rubbing down side with gouge.

E. Turning edge with gouge.



F. Diagram showing how scraper works.

To do this the scraper is held flat and the gouge drawn along each side in turn as at *D*, the blade being held perfectly flat. The turning process is then repeated as at *E*. This rubbing down and turning with the gouge can be done several times, until it fails to produce a keen edge, after which the scraper must be again rubbed down with file and stone.

Normally the scraper can be held at right angles with the grain, but if the grain is specially difficult, or if there is a cross-banding or inlay, it is advisable to hold it at an angle as shown in Fig. 22.

§5. THE SPOKESHAVE AND RASP

The Spokeshave

The spokeshave is used for shaped surfaces. Two kinds are available, those of wood and those of metal, and each can be obtained with either a flat

FIG. 24.—THE WOOD SPOKESHAVE IN USE.
The tool should always be worked *into* the grain.

face (used mainly for convex shapes) or a round face (for cleaning up concave surfaces).

Fig. 24 shows the wooden type in use. The important point to watch is the direction of the grain, be-

FIG. 25.—USE OF SPOKESHAVE.
How grain affects direction in which spokeshave is worked.

cause the tool is liable to cause the grain to tear out badly if worked against it. Fig. 25 shows the idea. To sharpen the cutter either a stone slip may be used, or the usual oilstone must be turned on edge as in

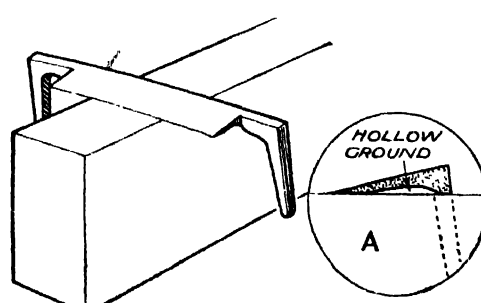


FIG. 26.—SHARPENING SPOKESHAVE CUTTER.

Fig. 26. The cutter is ground hollow, and it should be held flat on the stone as at *A*. Afterwards the burr can be rubbed off, keeping the face of the blade *flat*. Cutters of the metal spokeshave are

tool makes a slicing cut. By gripping with the thumb of the left hand underneath the chisel, the forward movement can be arrested, so preventing it from jerking forward and splitting out the corner.

In Fig. 32 a corner is being taken off. Note that the wood rests upon a flat, solid part of the bench, so that it does not splinter out the underside. The finger of the left hand passing round the chisel both guides and steadies the blade.

The handle should be struck with the mallet when chopping out has to be done. A hammer will soon fray out the end. The firmer-chisel only is used. One branch of chopping out is in cutting a mortise, and though the firmer can be used, there is a danger that it may snap. Consequently a special form of chisel made for the purpose is used. An example is given at *C*, Fig. 29. It is known as a sash chisel, and is not quite so cumbersome as the full mortise type. The method of chopping a mortise is dealt with in a later section, but it may be mentioned here that the most useful size is $\frac{5}{16}$ in. The reason for this is that most wood to be mortised is $\frac{7}{8}$ in. thick, and, as the mortise should be as near one-third of the thickness as possible, this size most nearly fulfils that requirement.

§8. VARIOUS TOOLS

Tools for Boring

For most work a brace with an 8 in. sweep is the most useful. Those who care to go to the extra expense might with advantage obtain a ratchet brace, because this is so handy when working in a corner.

A brace of this kind is shown in Fig. 1. It is important that it be held upright, and a good plan for a start is to place a square on the bench at the side as a guide as in Fig. 33. One point to note is that it is easier to tell whether a brace leans to the left or right than whether it is leaning away from or towards one. Consequently, for such jobs as dowelling, where it would be fatal for the bit to run out at the side, the worker should stand at the end. Should the hole lean a trifle along the length of the work it would not be so disastrous, though it would obviously be better for it to be perfectly upright.

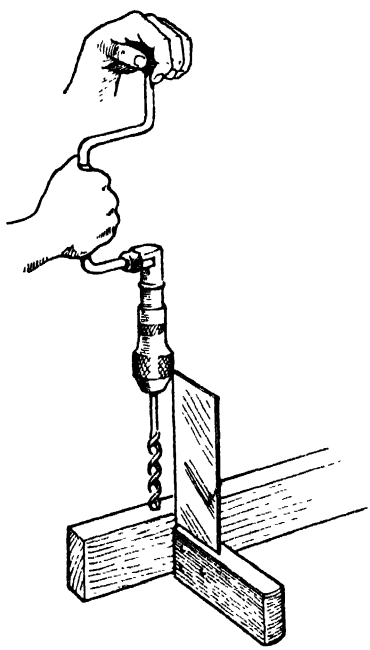


FIG. 33.—USE OF SQUARE WHEN BORING.

One of the most useful bits is the $\frac{3}{8}$-in. twist-bit, because it is needed in dowelling. A smaller one, $\frac{1}{4}$ in., is handy when mortising to clear out the bulk of the waste before chopping. When a number of holes have to be bored to the same depth, either a piece of paper can be stuck to the bit as a guide (Fig. 34) or a depth-gauge can be fixed on as in Fig. 35. The latter is easily made from two pieces of

wood screwed together with a centre notch to hold the bit.

Centre-bits are suitable only for boring comparatively shallow holes. For deep holes in end grain they are useless, because they are liable to drift with the grain, since there is no spiral portion, as in a twist-bit, to keep them true.

A shell-bit is handy for boring screw-holes. A size of about $\frac{1}{8}$ in. is the most useful. A countersink is also needed. This seldom requires sharpening, but a few rubs with a small, flat file and a rat-tail file soon restore its edge.

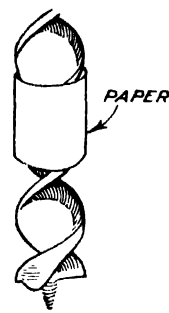


FIG. 34.

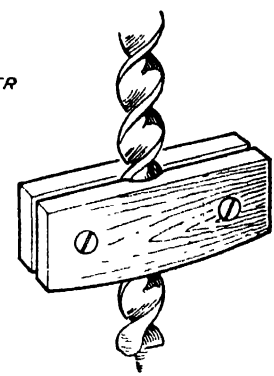


FIG. 35.

FIG. 34.—PAPER STUCK TO BIT TO ACT AS DEPTH-GAUGE.

FIG. 35.—DEPTH-GAUGE FIXED TO BIT.

Another invaluable tool for use in screwing is the bradawl. In use the blade should point across the grain. To sharpen it the oilstone can be used, or if gashed it can first be rubbed down with a file.

The Oilstone

An oilstone is an essential part of the kit. To prevent it from shifting about, a piece of leather can be glued at each end underneath. Do not try to economise unduly on the stone. A cheap one is generally useless—or rapidly becomes so. An

" Indian " or a " Carborundum " stone is excellent. " Washita " stones, too, are good, though one occasionally comes across one which becomes hard and loses its cut. Use a good-quality, fairly thin oil, and wipe the stone after use. A slip is needed for sharpening some gouges, and is handy also for the spokeshave.

Marking and Testing Tools

A 2-ft. folding rule is the most convenient for general use. When marking a size it should be turned on edge, so that the calibrations actually

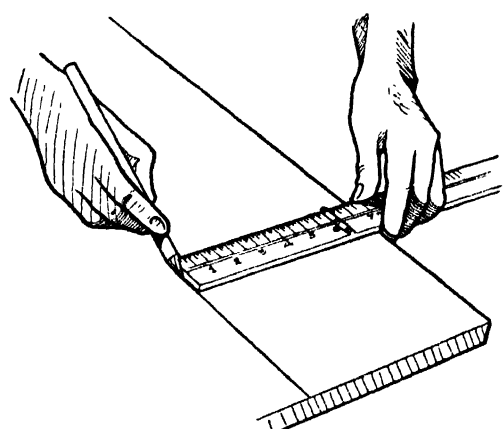


FIG. 36.—MARKING LINE PARALLEL WITH EDGE.

touch the wood. Long lengths of timber can be marked out parallel from one straight edge by using the index finger of the left hand as a gauge as in Fig. 36, though such marking is only approximate.

A square is needed for both marking and testing,

and a point to note about its use is that the butt should always bear against either the face side or the face edge. A similar tool to the square is the set-mitre used for testing mitres. The blade is set at 45 degrees.

A gauge is essential for accurate work. Two kinds are available, the marking and the cutting

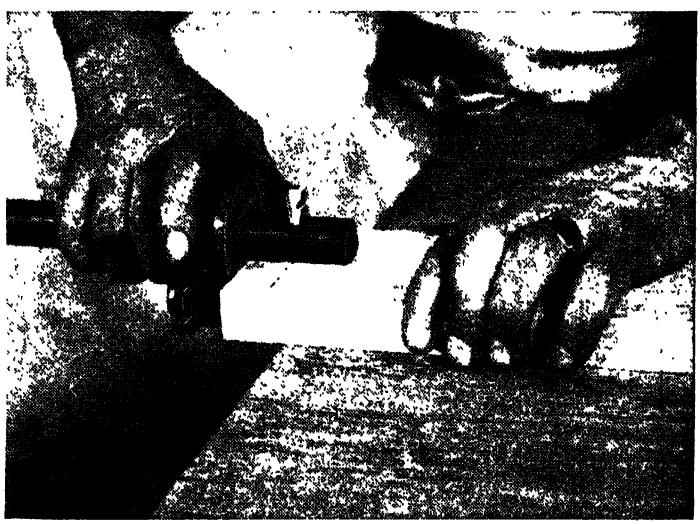


FIG. 37.—USE OF THE CUTTING GAUGE.
This can be used across the grain as here as well as *with* it.

gauge. The latter is recommended because it can be used *across* the grain as well as with it. Fig. 37 shows how it is held. When working *with* the grain, be careful to avoid allowing the gauge to run with the grain. The inward pressure of the second finger helps to prevent this.

When mortising, a mortise gauge is needed. This

is a similar tool, but is provided with a second adjustable marker as shown in Fig. 38.

Other Tools

The hammer is a fairly obvious requirement. The Warrington pattern with flat pane is recommended. A punch is also useful for sinking nails. A medium size of screw-driver is best to begin with. Pincers are needed when nailing, and a handy note here is that, to avoid bruising the wood, a piece of flat steel such as a scraper can be placed underneath as shown in Fig. 39. A mallet is required for striking chisels, as this will not fray the handles. The cork rubber is required when glasspapering, because, if the glasspaper is held in the

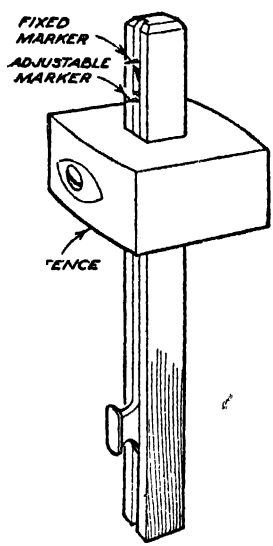


FIG. 38.—THE MORTISE GAUGE.

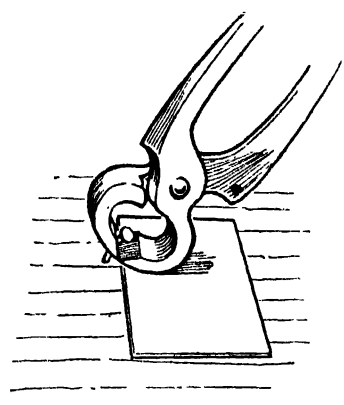


FIG. 39.—USING PINCERS.
Scraper placed beneath prevents wood being bruised.

hand only, it will not take out any inequalities, and the corners are liable to be dubbed over. Fig. 40 shows how it should (and should not) be used.

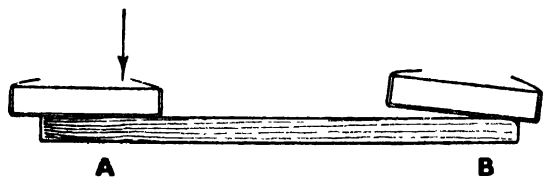


FIG. 40.—USE OF CORK RUBBER.

A. Correct use. Note where pressure is applied.
B. Faulty use showing ends dubbed over.

Cramps are needed when glueing up, and to hold down wood whilst being worked. A couple of sash

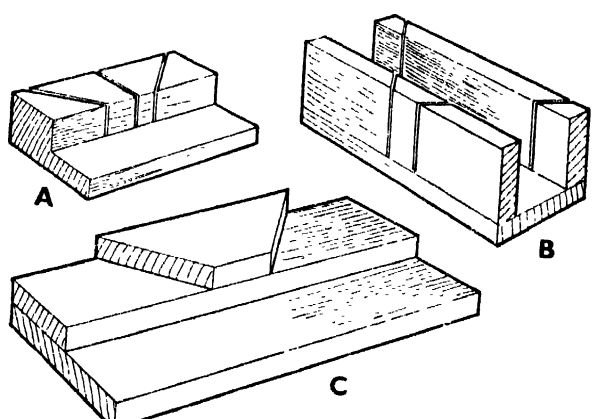


FIG. 41.—APPLIANCES FOR MITREING.

A. Mitre block. *B*. Mitre box. *C*. Mitre shooting-board.

cramps are invaluable when assembling doors, frames, glued joints, and so on. Thumbscrews are

handy for small work, and handscrews or G cramps for larger pieces.

For mitreing mouldings the mitre-block for small work and the mitre-box for large work are really essential. They are shown in Fig. 41. This illustration also shows a mitre shooting-board used for trimming mitres after sawing.

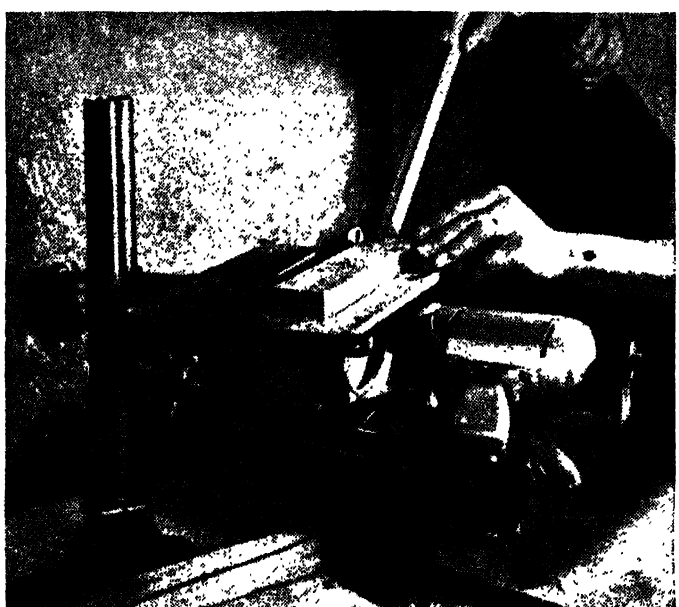


FIG. 42.—RIPPING ON THE CIRCULAR SAW.

§ 9. DRILLS

Electric drills are widely used in the workshop, especially in conjunction with the various attachments made for them. These include circular saw, disc sander, orbital sander lathe, moulder, and so on.

CHAPTER II

JOINTS AND THEIR APPLICATION

§1. NAILED AND SCREWED JOINTS

Nailing

ALTHOUGH nailing seems an obvious sort of thing, there are right and wrong ways of doing it, and there are undoubtedly pitfalls. For instance, there is the old danger of splitting when nails are driven in at the end of a board. In such a case it is always a safeguard to bore the holes first.

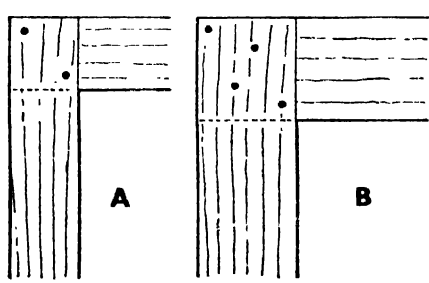


FIG. 1.—NAILING FRAMEWORK CORNERS.
A. Two-nail. *B*. Four-nail.

A simple corner joint is shown in Fig. 1, and it will be noticed that the nails are staggered. This again helps in preventing the wood from splitting.

When a simple box is being made with nailed corners, it is important that the edges are square. Otherwise there will be a gap at one side as at *A*, Fig. 2, which is weak, apart from being unsightly,

or the parts will fit together out of square as at *B*. The strength of such a joint can be increased by "dovetailing" the nails—that is, driving them in

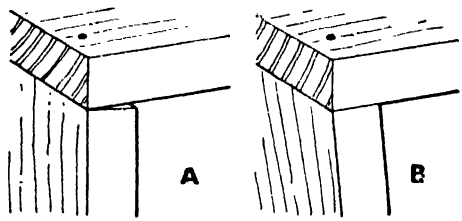


FIG. 2.—FAULTS IN NAILING.
There is either a gap as at *A*, or parts are out of square (*B*).

askew in alternate directions. For rough work, in which the parts are put together in their thickness, long nails can be used so that they can be clenched at the back.

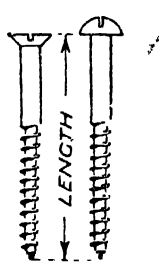


FIG. 3.—HOW LENGTH OF SCREWS IS CALCULATED.

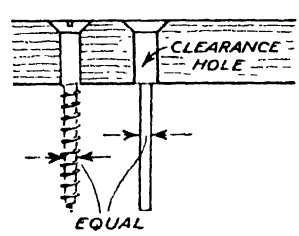


FIG. 4.—SIZES OF HOLES BORED WHEN SCREWING.

Screwing

Screws are obtainable in various forms and metals, but the most commonly used are the countersunk form and the roundhead shown in Fig. 3. This illustration shows how the length of the two kinds is

calculated. In all cases the wood which holds the shank should be bored with an easy clearance fit. It should never be tight. It is only the wood into which the screw portion is driven that should be tight. The hole should be about the size of the diameter of the centre portion, so that the spiral flange or screw part bites into the wood and so holds. This is shown clearly in Fig. 4.

In the ordinary way there is no difficulty about counter-sinking a screw, but sometimes a thick piece of wood has to be screwed to a comparatively thin piece. For example, a table-top is often screwed on, and to drive the screws right through the rails would necessitate long screws. The method known as pocket screwing is therefore usually adopted. This is shown in Fig. 5, in which a cut is made with a gouge in the inside of the rail, enabling a shorter screw to be used. To do this the clearance hole is bored at an angle from the top edge of the rail, so that it emerges inside. The gouge-cut is then made deep enough to take the head of the screw.

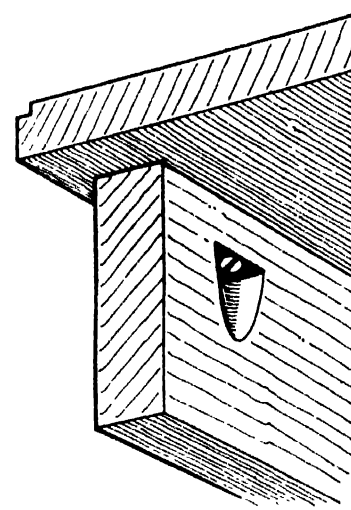


FIG. 5.—METHOD OF POCKET SCREWING.

§2. GLUED JOINTS

When it is necessary to produce a wide surface it is necessary to glue together two or more pieces. In the best form the two parts are planed to make a perfect joint, and are "rubbed" together—that is, the one piece is fixed in the vice, the surfaces are glued, and the upper piece is placed in position and rubbed back and forth so that all surplus glue is squeezed out. The advantage of this is that the parts retain their natural shape. It is satisfactory for joints up to about 3 ft. in length. For longer work, however, it is desirable to use cramps, and in this case the joint is shot a trifle hollow, and one or more cramps are put on in the centre. In this way the ends are naturally pressed tightly together —a desirable feature, because the ends are the most vulnerable points.

The first step is to mark the joining edges, so that the parts can be replaced in the correct positions.

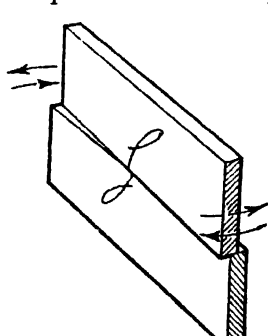


FIG. 6.—TESTING JOINT BY "SWIVELLING."

The joints can be shot either in the vice or on the shooting-board. In the former case a square should be used to test the edges to ensure the two pieces being in alignment. When the shooting-board is used, the one piece is planed with the face side uppermost, and the other with the face side downwards. In this way they will fit together square.

If the joint is held to the light, it can be seen whether it is making a close fit; but in any case the upper piece should be swivelled back and forth as in Fig. 6. A round joint will merely pivot at the centre, whereas a correctly planed one will give friction at the ends, showing that they are touching.

In all cases when Scotch glue is used the joints

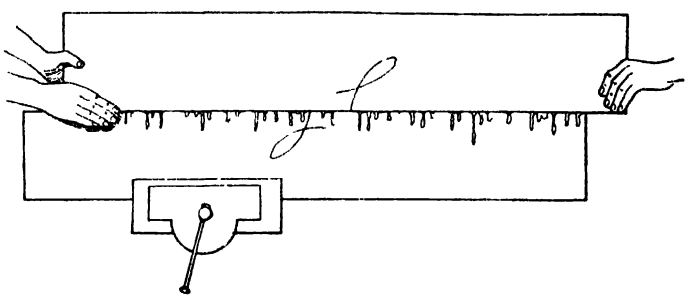


FIG. 7.—HOW LONG JOINT IS RUBBED.

should be heated to prevent the glue from chilling, and, when rubbing the upper piece, the hands should be kept low at the ends, so that the joint is not broken. This is shown in Fig. 7. When the glue is drying, the joints can be stacked as shown in Fig. 8, each resting across its entire width upon a batten.

It is advisable to test a cramped joint with the straight-edge as shown in Fig. 9, because if the cramp is not put on correctly, it may tend to pull the joint out of alignment. If the upper piece leans forward, the cramp should be put farther back.

Thin wood of, say, $\frac{1}{8}$ in. thickness should be planed on the shooting-board, because otherwise it

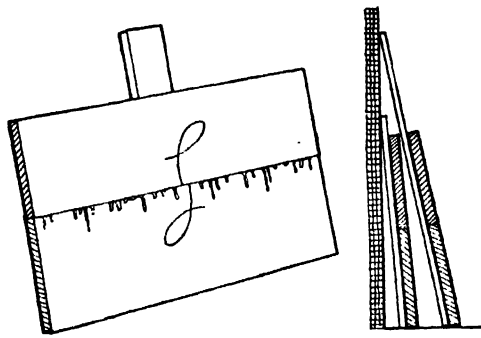


FIG 8.—STACKING JOINTS WHILST DRYING.

is difficult to keep the edge square. When glueing up, two battens are laid on the bench, a sheet of

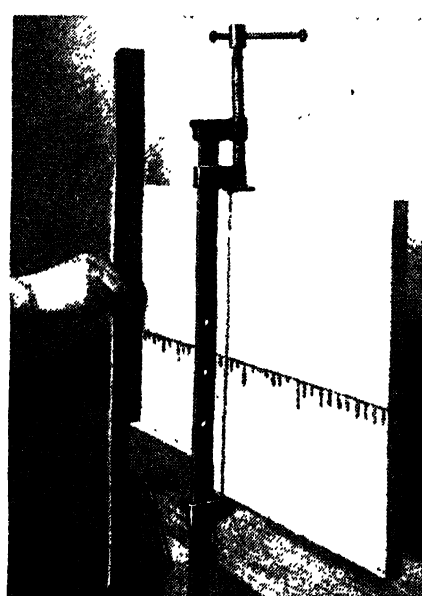


FIG. 9.—TESTING CRAMPED JOINT WITH STRAIGHT-EDGE.

paper is placed over them, and the joint rubbed together flat as in Fig. 10. If cramps are required, as in the case of a long joint, battens must be put on with thumbscrews at both sides to prevent buckling.

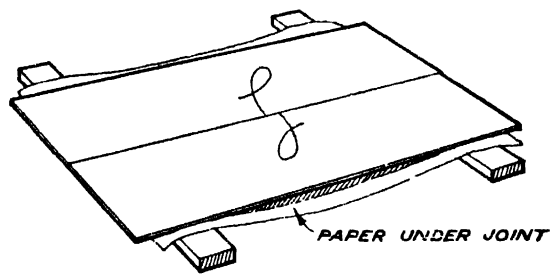
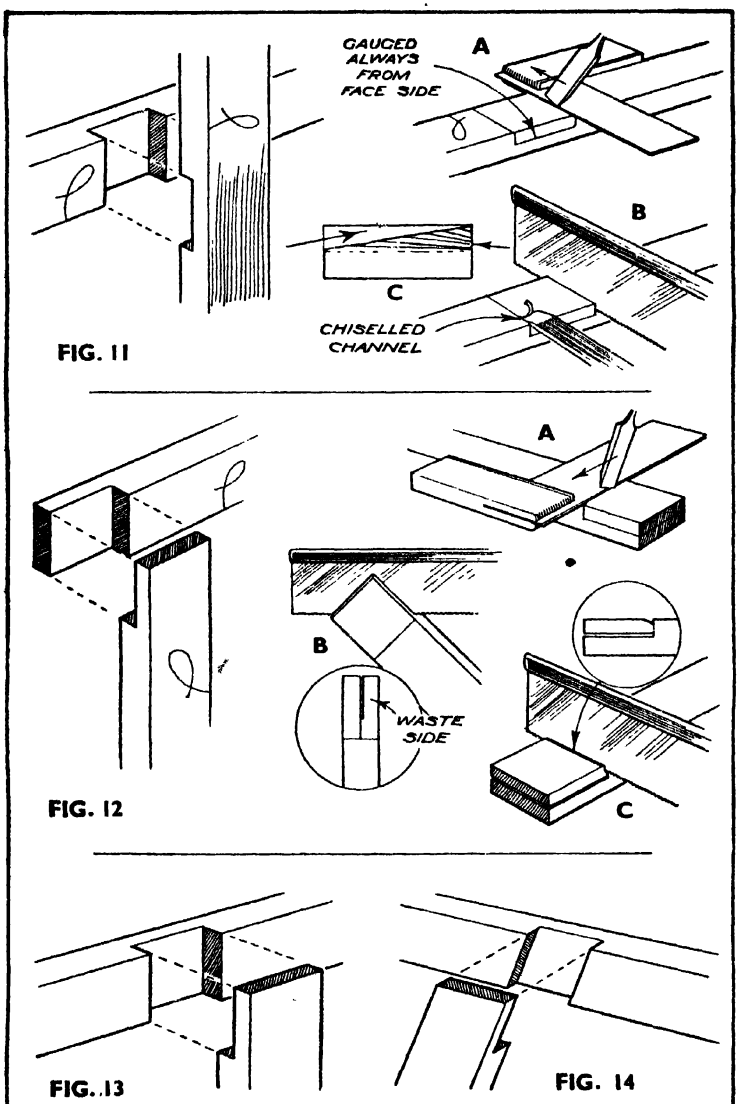


FIG 10.—ASSEMBLING JOINT IN THIN WOOD.

§3. HALVED JOINTS

In Fig. 11 is a halved joint used for joining two pieces at right angles, the joint occurring at the centre. The width of the wood is marked across with chisel and square as at *A*, and returned at the edges with pencil marks. To mark the depth, the gauge is used from the face side in both cases, so that the two parts are bound to fit together level even if the gauge is not set exactly to the middle. The sides of the groove are cut in with the saw, and, to provide a channel in which the saw can run, a small sloping groove is made with the chisel on the waste side. After sawing the sides the waste is chiselled first from one side (left at C) and then from the other as shown by the arrows.

The corner halved joint in Fig. 12 needs the use



TYPES OF HALVED JOINTS AND HOW THEY ARE CUT.

When the waste is sawn away the saw is held to the side of the line so that the latter is left in.

of the saw only for cutting. It is marked out with chisel and square as at *A*, a small extra allowance being made in the length for trimming. As before, the line of the halving is gauged from the face side only, and when being cut the saw is worked at the side of the line as shown inset at *B*. It is best to fix the wood in the vice at an angle and cut down as far as the diagonal. It can then be reversed, this time upright, and the cut completed. *C* shows the shoulder being sawn.

Fig. 13 is a combination of the two joints already given, and Fig. 14 shows a similar joint with the one member set obliquely.

§4. MORTISE AND TENON JOINTS

The mortise and tenon joint has many applications. Its simplest form is shown at *A*, Fig. 15. The thickness of the tenon is as near as possible one-third that of the wood. It is used for simple doors, frames, and all similar jobs in which two comparatively narrow pieces are joined together at right angles.

A rather more elaborate variation is that at *B*, in which the wood is rebated at the back to hold a panel as in a door. This means that the back shoulder has to be cut longer than the front one by an amount equal to the depth of the rebate. When making it, the rebate is marked out with the gauge, but is not worked until after both mortise and tenon have been cut.

C is similar to that at *A*, but has a haunch at the

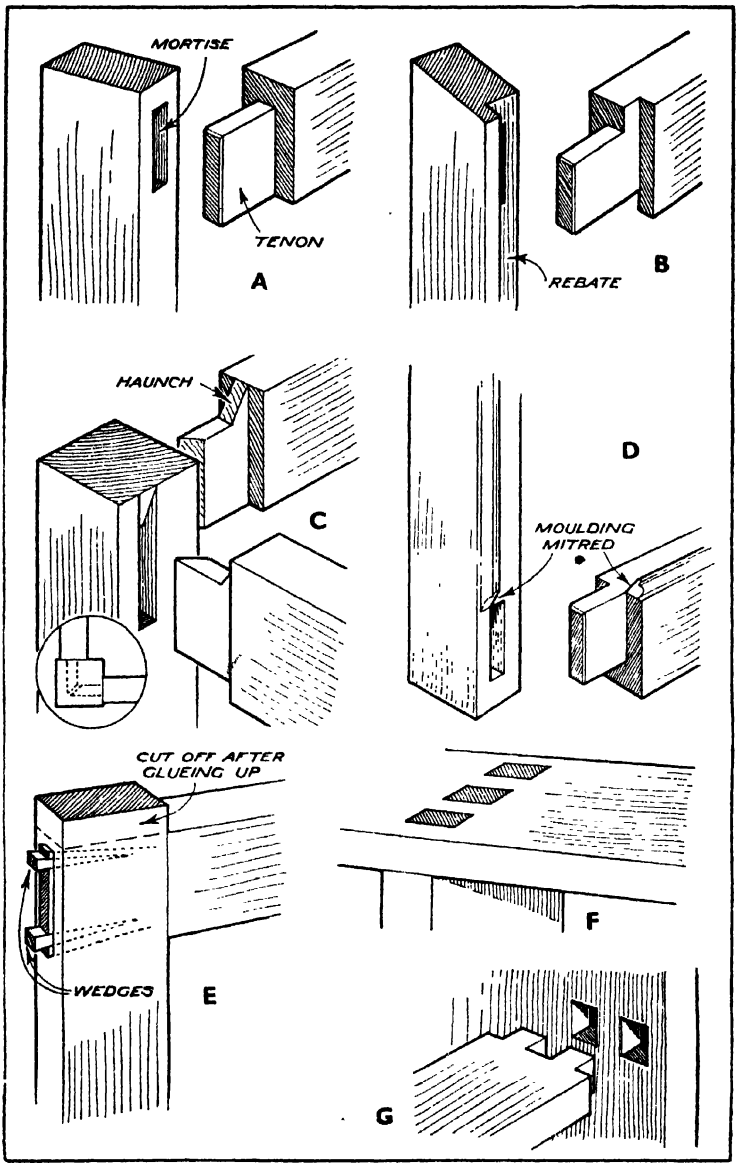

MORTISE
TENON
A
REBATE
B
HAUNCH
C
D
MOULDING
MITRED
CUT OFF AFTER
GLUEING UP
WEDGES
E
F
G

FIG. 15.

top to prevent any twisting tendency. As the haunch is tapered, it is invisible at the top. The joint is used when two rails have to be joined to a leg. Note from the inset sketch how the ends of the tenons are cut at an angle so that they have the maximum length.

At *D* the wood is rebated, but a moulding is worked at the front edge. In this case the shoulders are level because the moulding is cut away and mitred. It should be noted that when a door is made the shoulder length is taken from the rebate depth, not from the edge of the moulding.

A joint useful for outdoor work is the through-wedged type at *E*. The mortise is cut extra long at the outer edge, and two saw cuts are made, one at each side of the tenon. After glueing up, a wedge is driven into each so that it is impossible to pull the two apart.

Making the Simple Mortise and Tenon Joint

Fig. 16 shows the stages in cutting the mortise and tenon joints when making a door. Having planed up the wood, the two pieces for the rails are fixed together and the shoulder positions marked out as at *B*. After marking both together as shown,

FIG. 15.—VARIOUS FORMS OF MORTISE AND TENON JOINTS.

A. Single mortise and tenon joint.
B. Joint for rebated framework.
C. Haunched tenons meeting at leg.
D. Framework with mitred moulding worked in the solid.
E. Through tenon wedged at outside.
F. Through tenons for carcase work.
G. Drawer rail joint.

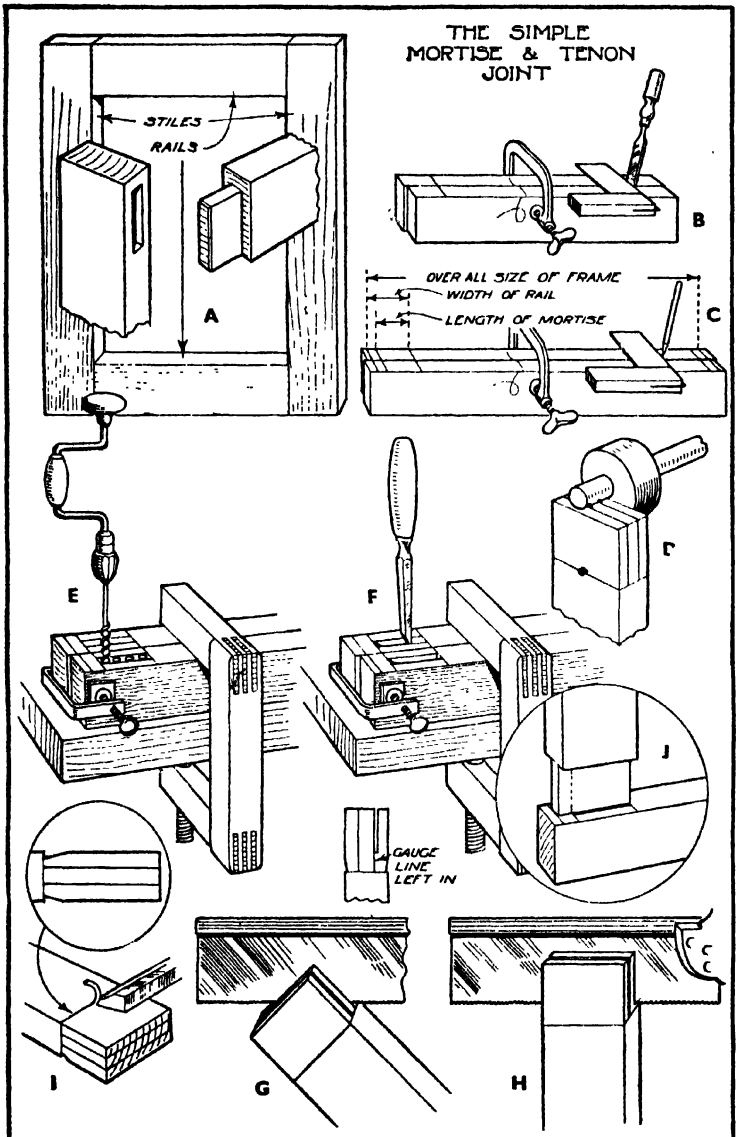

THE SIMPLE
MORTISE & TENON
JOINT
STILES
RAILS
A
B
OVER ALL SIZE OF FRAME
WIDTH OF RAIL
LENGTH OF MORTISE
C
D
E
F
J
GAUGE
LINE
LEFT IN
I
G
H

FIG. 16.

they are separated and the marks squared around both individually on all four sides. The stiles follow as at *C*. A mortise gauge is now set so that the two markers are spaced to the width of chisel being used. The fence is set so that the two marks are central, and all the parts marked from the face side as at *D*.

Chopping the mortises is shown at *E* and *F*. A great deal of the waste is removed by boring, using a bit slightly smaller than the mortise width. The chopping follows as at *F*. The chisel is started at the middle, and is struck with the mallet. It is gradually worked first towards one end, then towards the other, the depth being increased at each cut.

When the tenons are sawn, the wood should be fixed in the vice at an angle, and the cut taken down as far as the diagonal as at *G*. It is then reversed, this time upright, and the cut completed as at *H*. Note that the cuts should be made *outside* the gauge lines, so that the last-named are just left in. Before sawing the shoulders, a chisel-cut should be made as at *I*. This forms a channel in which the saw can run.

The last job is fitting the tenons. Each tenon is placed opposite its mortise as at *J*, and a pencil

FIG. 16.—CUTTING MORTISE AND TENON JOINTS FOR A DOOR.

A. Door with joint in detail.
B. Marking the rails.
C. Marking the stiles.
D. Using mortise gauge.
E. Boring away the waste.
F. Chopping the mortises.
G. First stage in sawing tenons.
H. Finishing tenons.
I. Cutting channel at shoulder.
J. Fitting the joint.

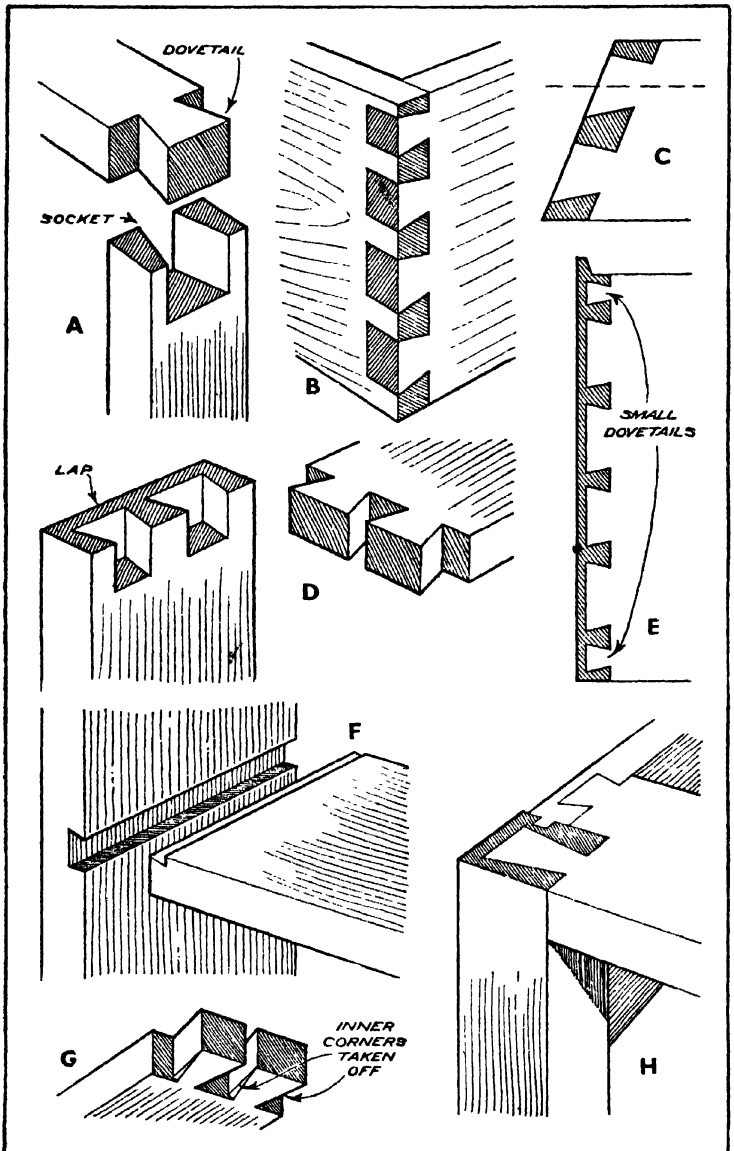

DOVETAIL
SOCKET
A
B
C
SMALL
DOVETAILS
E
LAP
D
F
G
INNER
CORNERS
TAKEN
OFF
H

FIG. 17.

mark made. The waste is then sawn away, and any final fitting completed.

§5. DOVETAIL JOINTS

Various Kinds of Dovetails

The simplest form of dovetail is shown at *A*, Fig. 17. One of the commonest ways in which it is used is in joining the sides of a box as at *B*. Simple cabinet carcases, frames of various kinds, and drawers call for its use. Sometimes one of the joining pieces has to be at an angle as at *C*, and here it should be noted that the slope of the dovetail is set out equally at the sides of a line parallel with the sides of the piece in which the dovetails are cut.

Lapped dovetails are used when the joint requires to be concealed at one side. An example is given at *D*. The only difference in the marking out is that the gauge giving the dovetail length is set to the thickness of the wood in which the sockets are cut, less the thickness of the lap.

A bare-faced housed dovetail is given at *F*. These joints are handy when fixed shelves have to be fitted to a tall bookcase, as they prevent the sides

FIG 17.—VARIOUS FORMS OF DOVETAILS.

A. Through dovetail.
B. Through dovetails applied to a box.
C. Correct slope when piece with sockets is at an angle
D. Lapped dovetail.
E. Lapped dovetails for cabinet carcase top
F. Barefaced housed dovetail
G. Corners taken off to ease assembling.
H. Lapped dovetails of table framework.

from bulging outwards. The joint at *H* is a lap dovetail as applied to a table framework. The side

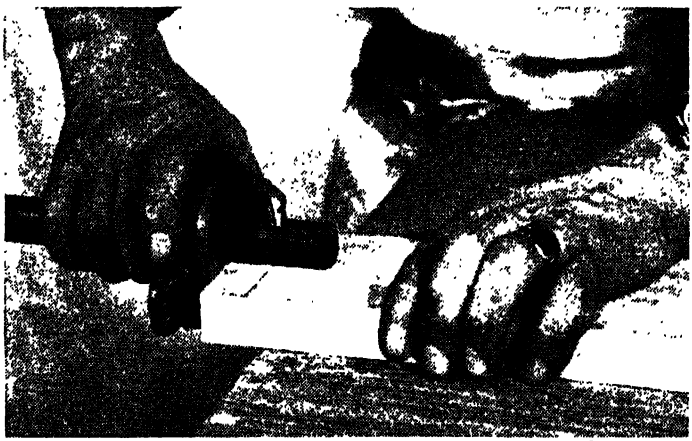


FIG. 18.—GAUGING THE ENDS
The gauge is set to the thickness of the wood.

rail is tenoned to the leg and is glued up. The front rail is then dovetailed in as shown.

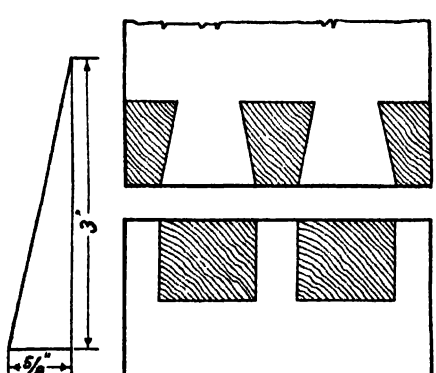


FIG. 19.—HOW DOVETAIL SLOPE IS SET OUT.

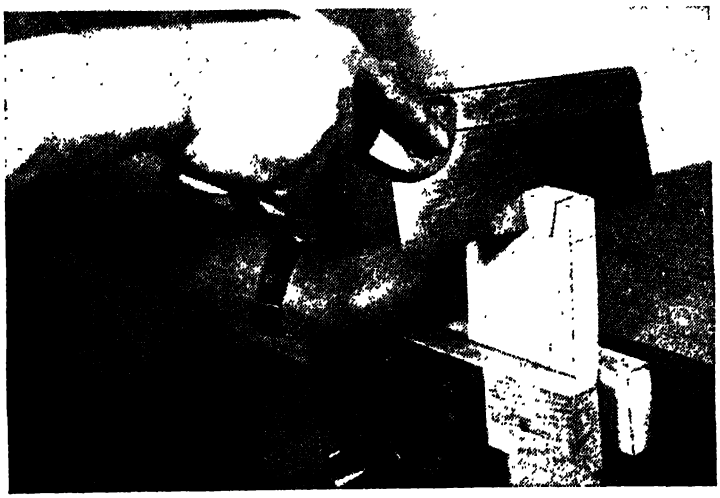


FIG. 20.—CUTTING THE DOVETAILS.
Take care not to saw past the gauge lines.

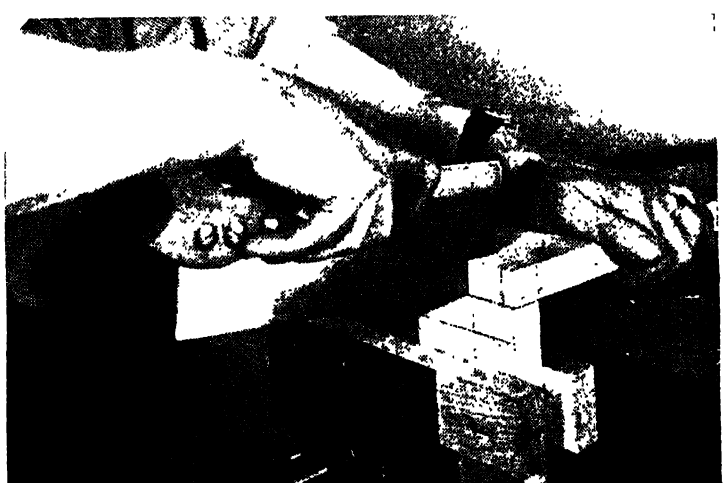


FIG. 21.—MARKING OUT THE SOCKETS.
The saw is placed in each kerf in turn and is drawn backwards.

Cutting a Through Dovetail

When dovetailing two pieces together, the ends to be jointed must be planed square. A cutting-

FIG. 22.—CHOPPING THE DOVETAILS.
They are cut halfway through from each side.

gauge is set to the thickness of the wood, and both pieces are gauged all round as shown in Fig. 18. The position of the dovetails is now marked in with pencil. The angle is important. A slope of $\frac{5}{8}$ in. in 3 in. is correct, as shown in Fig. 19. Fig. 20 shows the dovetails being cut.

To transfer these marks, the piece having the sockets is held in the bench vice and the other laid upon it in the exact position. The saw is then placed in each kerf in turn and is drawn backwards as shown in Fig. 21. The sides of the sockets are then sawn, the cut being made slightly to the *waste* side of the marks.

The chopping out of the waste pieces is shown in Fig. 22. When beginning the first chop the chisel is held about $\frac{1}{16}$ in. short of the gauge line. By making a second cut *with* the grain at the end a small piece can be taken out. The chisel can then be taken right to the gauge line. This will remove about half of the waste, after which the wood can be reversed and the remainder chopped out in a similar way. The two side pieces can be sawn off.

§6. DOWELLED JOINTS

These are used frequently by amateurs who hesitate to tackle mortise and tenon joints, though they are not so strong.

Fig. 23 shows the dowelled joint in the form in which it is used to replace the mortise and tenon. Note that a saw-cut is made along each dowel to allow the surplus glue to escape when the dowels are knocked in. The holes in both joining pieces are slightly countersunk, because glue is awkward to remove cleanly.

B shows the marking out after the wood has been prepared. The stiles (uprights) and rails (horizontals) are fixed together temporarily and the

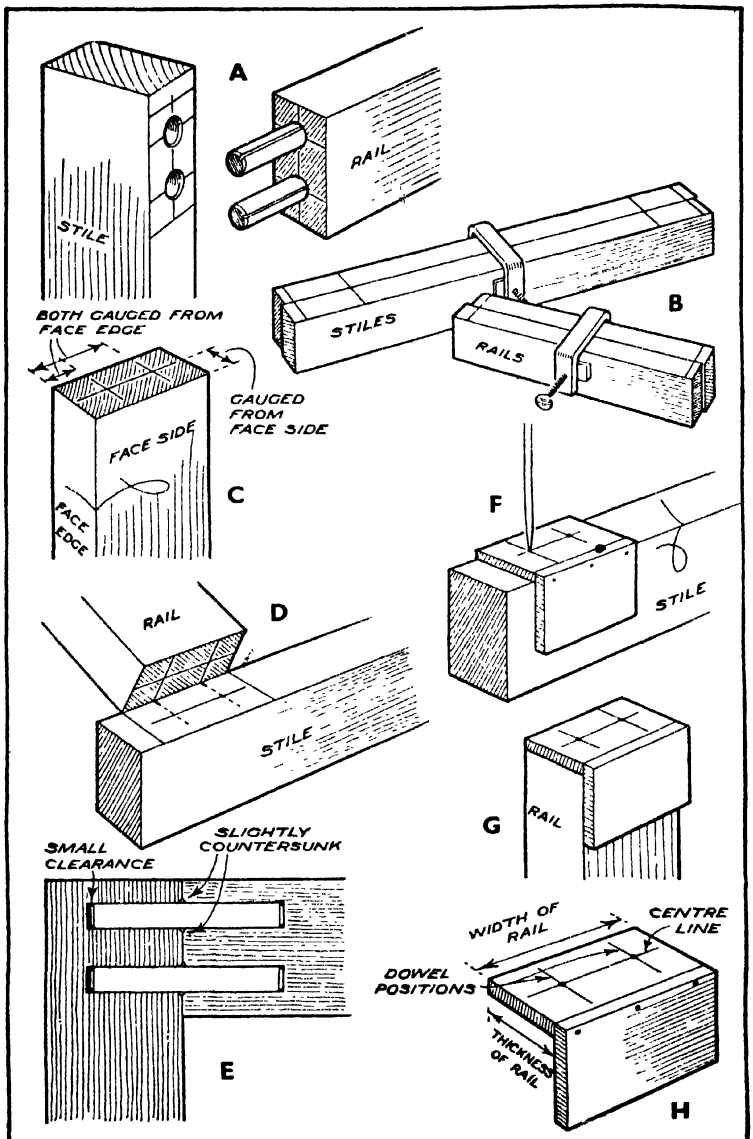

A
STILE
RAIL
B
STILES
RAILS
BOTH GAUGED FROM FACE EDGE
GAUGED FROM FACE SIDE
FACE SIDE
FACE EDGE
C
F
STILE
D
RAIL
STILE
G
RAIL
SMALL CLEARANCE
SLIGHTLY COUNTERSUNK
E
WIDTH OF RAIL
CENTRE LINE
DOWEL POSITIONS
THICKNESS OF RAIL
H

FIG. 23.

marks squared across. In the case of the rails a chisel should be used, and, after separating, they should be squared round on to all four sides. The surplus is then cut off, half from each side. The positions of the dowels are marked next. Set a gauge to the centre of the thickness and mark the ends of the rails from the face side. The stiles are also marked at the joint positions. Now mark in with a pencil the distance in of the dowels, and, setting the gauge to the one, mark all the rails. The other dowels are marked in the same way, the gauge being used from the face edge in every case as at *C*.

To transfer the marks to the stiles the rails are placed in position each in turn as at *D*. When boring, stand at the end of the work, so that any tendency for the brace to lean to one side is at once detected. For $\frac{7}{8}$-in. wood the usual size of dowel is $\frac{3}{8}$ in.

Cut up the dowels into suitable lengths and make a saw-cut along each. They can then be glued and stuck into the ends of the rails and the surplus wiped away. When a fair number of dowelled joints are to be made, it is an economy to make a simple template as at *H*.

FIG. 23.—METHOD OF CUTTING THE DOWELLED JOINT.

A. Completed joint. *B*. Marking out.
C. How ends of rails are gauged.
D. Transferring marks to the stiles.
E. Section through joint.
F. Marking stile with template.
G. Rail being marked with template.
H. Details of template.

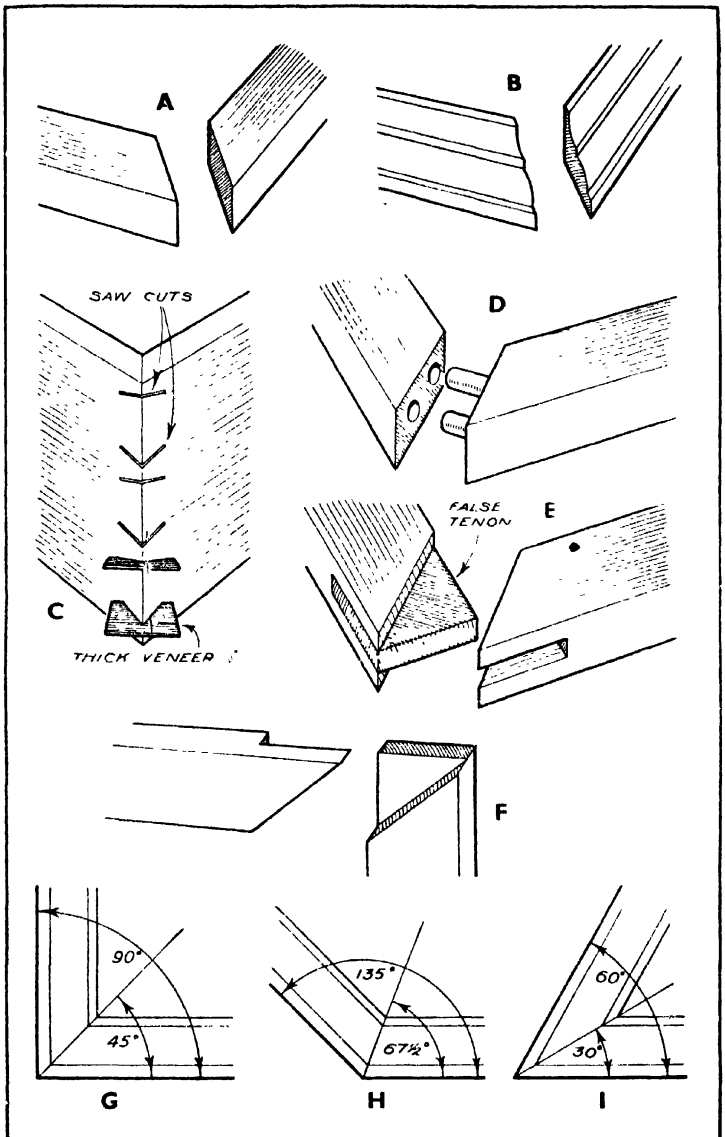

A
B
SAW CUTS
C
THICK VENEER
D
FALSE TENON
E
F
90°
45°
G
135°
67½°
H
60°
30°
I

FIG. 24.

§ 7. MITRED JOINTS

For fitting together mouldings the mitre is essential, but it is also sometimes necessary when jointing up plain wood. The golden rule to remember is that the line of the mitre always halves the over-all angle of the joining pieces. In most cases the last named are at right angles, and the mitreing angle of 45 degrees is fairly obvious. It is because of this that mitre blocks and similar appliances are made at 45 degrees. When the joining pieces are not at right angles, however, the 45 degrees angle is useless. The idea is shown in Fig. 24 at *G*, *H* and *I*.

In its simplest form the surfaces of the mitre are plain as at *A*. It requires merely to be cut with the saw and, if necessary, trimmed on the mitre shooting-board. The same joint applied to a moulding is given at *B*. *C* shows a way of strengthening the joint. The joint is cut with plain surfaces (as that at *A*) and is glued up. When the glue has set, a series of saw-cuts is made dovetail fashion across the corner and pieces of stout veneer are glued in them. The projecting pieces are levelled down after the glue has set.

At *D* the joint is strengthened with dowels. A somewhat similar but stronger joint is that at *E*, in which slots are cut and a loose or false tenon is glued in. If desired, the tenon could be cut in the solid in one of the pieces. When the mitre need show at the front

FIG. 24.—TYPES OF MITRED JOINT AND HOW ANGLE IS FOUND.

A. Simple mitre.
B. Mitre applied to moulding.
C. Strengthening mitre with veneer keys.
D. Dowelled mitre.
E. Mitre with false tenon.
F. Halved mitre.
G, *H*, *I*. How mitre line bisects over-all angle of joining pieces.

only, the halved mitre at *F* could be cut. The cutting of this is the same as that described for the halved joint.

§ 8. GLUE

Scotch glue is still widely used for woodwork, and is suitable for any work not liable to become damp. It must be used hot (though it should never be boiled) and calls for care in both its preparation and use. The cake glue should be broken up into small pieces, steeped in water, and left overnight. The next day it is heated in a proper glue kettle (never over a flame) until it is just too hot to be borne on the flesh. Heat the parts being joined so that the glue is not chilled, but take care not to scorch the edges.

Resin glue is widely used today. The cold-application urea variety has many advantages, especially on jobs which take a fair time to assemble, there being no risk of chilling. Some glues have a separate water-like hardener, and in this case the glue is applied to one part of the joint and the hardener to the other. Other types have the hardener incorporated in the glue. It is in powder form and requires only to be mixed with water. One advantage is that it is highly water resistant, and is therefore specially suitable for work exposed to damp.

Casein glue is used cold and is more water-resistant than Scotch glue, but it is liable to stain certain hardwoods. As it has no tackiness it cannot be used for rubbed joints, or for the hammer method in veneering.

Poly-vinyl acetate glue is used cold and requires no hardener. It can be used for many other substances beside wood—plastics, hardboard, tiles, rubber, etc.

CHAPTER III

WORKSHOP PRACTICE

§1. HOW TO MAKE A DOOR

Flush Doors

ALTHOUGH the framed-up type of door with separate panel fitting in a groove or rebate is still used to a fair extent, the flush door is becoming increasingly popular.

In its simplest form the flush door is simply a piece of plywood or laminated board fitted to the cabinet; but this has the disadvantage of showing unsightly layers at the edges, and various means of concealing these have to be adopted. An edging or lipping about $\frac{1}{8}$ in. thick is applied all round, this being either planed flush, bevelled, or made to project in the form of a bead as in Fig. 1. One point to note is that plywood is suitable only when the hinges are fixed at the surface. If they are to be at the edge, there are complications, because the screws will not grip well in the layers.

The best form of flush door is that in Fig. 2, in which the edging is mitred round and both sides are veneered. The veneer thus conceals the edgings. This method is possible only when the door can be veneered *after* the edgings are fixed. If a ready-veneered piece of plywood is used, one of the methods in Fig. 1 must be followed. Note that the grain of the veneer runs at right angles with that of the outer layers of the laminated board.

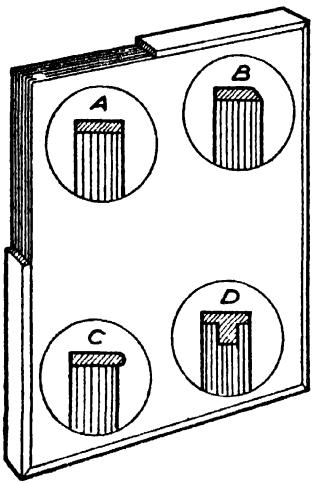


FIG. 1

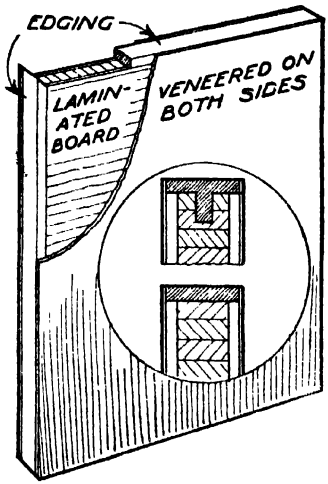


FIG. 2

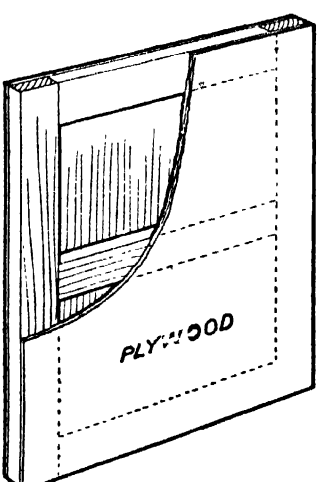


FIG. 3

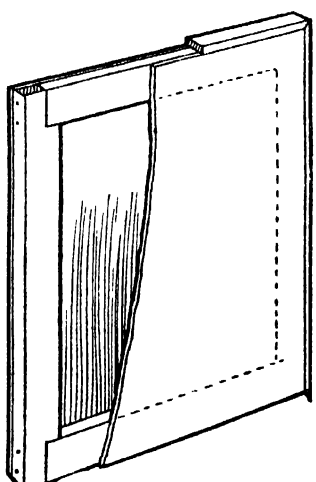


FIG. 4

Both the foregoing methods require the use of stout ply or laminated board, and a useful alternative is to make a thin inner framework and to fix to each side a sheet of $\frac{1}{8}$-in. or $\frac{3}{16}$-in. plywood as shown in Fig. 3. The joints of the framework should preferably be the mortise and tenon, though a halved joint could be used.

For a very simple door the construction at Fig. 4 could be followed. It is somewhat rough and ready, but is handy for quick jobs. In all these doors the plywood should be glued to the framework, and if this is properly done no other fixing will be necessary.

Panelled Doors

There are many varieties of these, the commonest of which is that with the panel fitting in a rebate as shown in Fig. 5. Its advantage is that the rebate is formed by an applied moulding (two types are given), which means that no rebate has to be worked. The simple mortise and tenon or dowelled joint can be used at the corners. The panel is held by a bead at the back. Sometimes it is required to fit the panel in grooves, and this necessitates grooving the rails as in Fig. 6.

When it is desired to eliminate joints altogether the simple method given in Fig. 7 can be followed. It does not make a very strong door, but it will do

VARIOUS TYPES OF FLUSH DOORS.

FIG. 1.—DOOR OF THICK PLYWOOD WITH LIPPING.
FIG. 2.—EDGED AND VENEERED LAMINATED BOARD.
FIG. 3.—FRAMEWORK WITH GLUED-ON PLY PANELS.
FIG. 4.—SIMPLE NOTCHED FRAMEWORK WITH PLY PANELS.

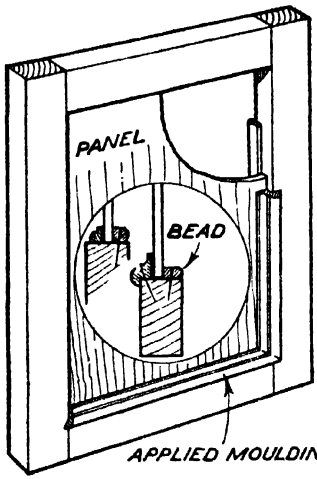


FIG. 5

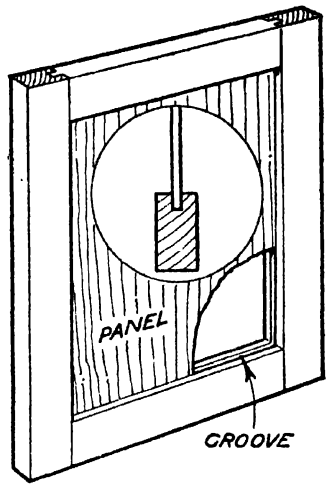


FIG. 6

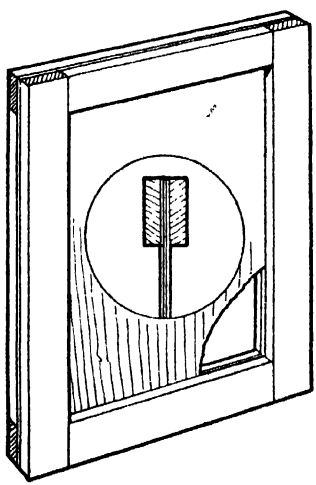


FIG. 7

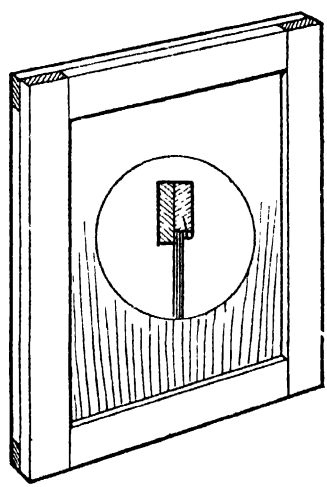


FIG. 8

for work not requiring a high standard of finish. A piece of $\frac{3}{16}$-in. plywood is cut to the over-all size, and $\frac{3}{8}$-in. or $\frac{1}{4}$-in. strips are glued and nailed around the edges, the joints being merely butted. Note that the front joint is upright and the back one horizontal. Another variation of the same thing is that in Fig. 8, in which strips of $\frac{1}{2}$-in. stuff are glued together. Those at the back are $\frac{1}{4}$-in. narrower than those at the front, so that a rebate is thus formed in which the panel can fit.

Making the Door

As an example of the procedure, let us suppose that a door has to be made to fit a cupboard, the inside size of which is 18 in. by 12 in. as in Fig. 9. To allow for trimming, the door should be about $\frac{1}{16}$ in. full in length and width, which means that the stiles will be marked to $18\frac{1}{16}$ in. The way in which the parts are fixed together whilst marking out has already been dealt with in Fig. 16, Chapter II.

The joints having been cut, each should be fitted individually and marked so that they can be replaced in the same positions. The whole thing is then tried together to see that it is free from winding. This is done by holding the framework in line with the eye, when the near and far rails should appear

FRAMED-UP DOORS IN VARIOUS FORMS.

FIG. 5.—DOOR WITH APPLIED MOULDING AND BEAD.
FIG. 6.—PANEL GROOVED IN.
FIG. 7.—SIMPLE DOOR WITH "FRAMEWORK" GLUED ON.
FIG. 8.—SIMPLE WAY OF MAKING DOOR WITH REBATE.

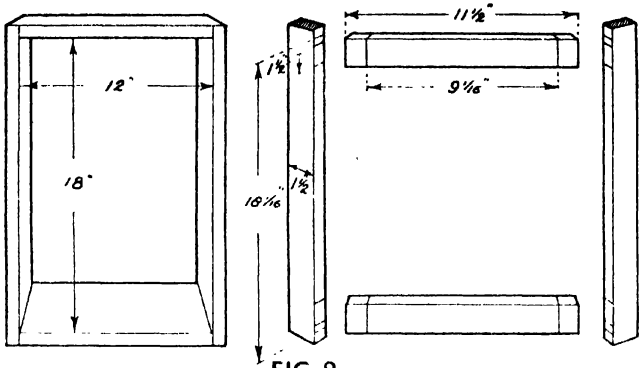
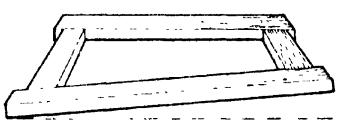


FIG. 9



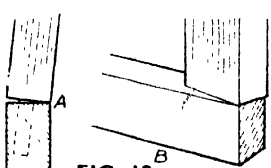


FIG. 10

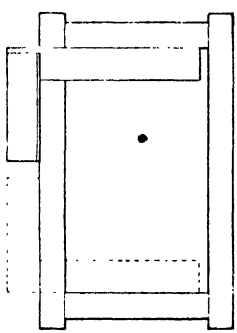


FIG. 11

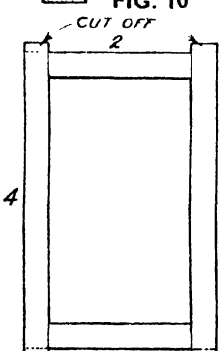


FIG. 12

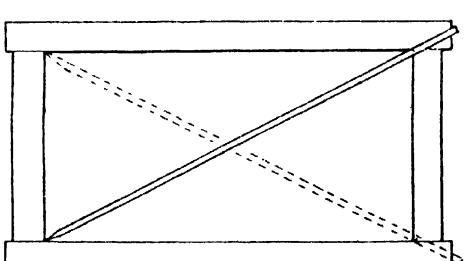


FIG. 13

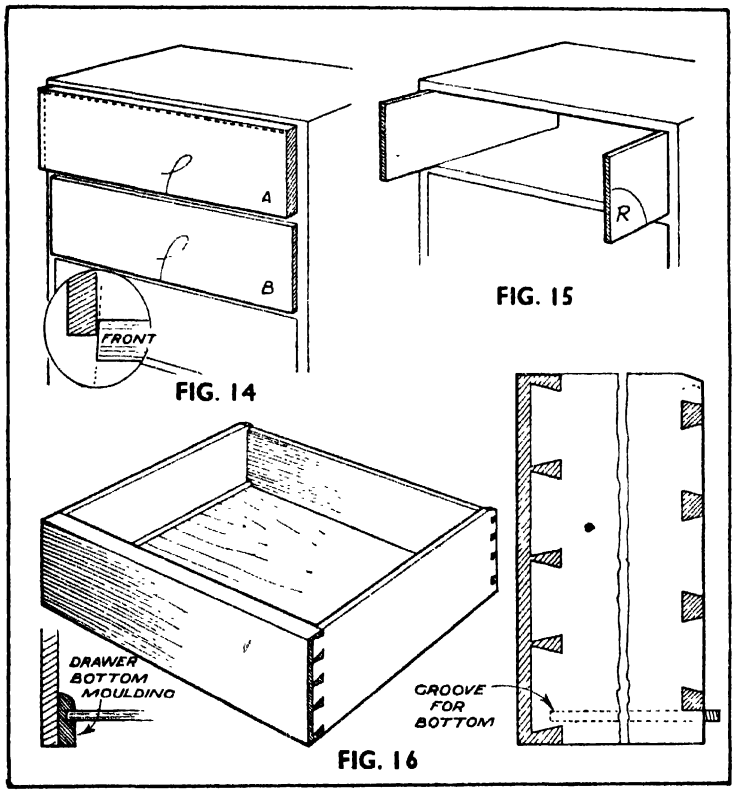
parallel. Fig. 10 shows a door in winding. The trouble is due to faults in the joints, and may be caused by either the mortise or tenon being cut at an angle (*A*), or by one or the other not being parallel with the side (*B*). The remedy is obvious.

It can now be glued up. Both mortise and tenon are glued, and the whole is cramped together. A small door such as that with which we are dealing can be tested for squareness with an ordinary try-square as in Fig. 11. In a larger one it is better to use the diagonal strip method, in which a lath of wood is pointed at one end and placed diagonally across the door and the length marked. When reversed into the opposite corners, it should show the same length as in Fig. 13.

When the glue has set, the projecting ends of the stiles are sawn off as in Fig. 12. The hingeing edge (right hand) is planed true, and the top edge trimmed so that it fits accurately against the cupboard. The bottom edge follows, and finally the opening edge (left hand) is fitted. The notes on hingeing given in Section 4, Chapter III, should be read, because it will be seen that this opening edge has to be planed at a slight angle. There should not be any gaps around any of the edges, but the door must not bind anywhere. Remember that if the job is to be polished later, the polish will build up a certain thickness.

STAGES IN MAKING A FRAMED-UP DOOR.

FIG. 9.—HOW SIZES ARE CALCULATED.
FIG. 10.—DOOR IN WINDING WITH (*A* AND *B*) LIKELY CAUSES.
FIG. 11.—TESTING DOOR WITH SQUARE.
FIG. 12.—ORDER IN WHICH EDGES ARE PLANED.
FIG. 13.—TESTING DOOR WITH DIAGONAL STRIP.



How Dovetailed Drawer is Made.

Fig. 14.—Fitting the Front.
Fig. 15.—Sides being Fitted.
Fig. 16.—Completed Drawer and Setting out of Dovetails.

The panel should never be glued in, as this may cause splitting. Incidentally it is always better to leave fixing this until after polishing, because it is awkward to work the polishing rubber into the corners. In the case of a grooved-in panel it cannot be avoided, but even here the edges should be stained

before assembling, so that in the event of shrinkage there will not be any edges of white, unstained wood showing.

§ 2. MAKING A DRAWER

A Dovetailed Drawer

The best way of making a drawer is to dovetail it. For the usual run of drawers a thickness of $\frac{7}{8}$ in. or $\frac{3}{4}$ in. is suitable for the front. The sides and back can be $\frac{3}{8}$ in., and the bottom $\frac{3}{16}$ in. The latter is nowadays usually of plywood, and is held by a grooved moulding made specially for the purpose.

Plane the lower edge of the front true, and trim one end so that it makes a perfect fit with the side of the cabinet. If it is placed in position as at *A*, Fig. 14, it is easy to test. Mark the exact length and width, and trim first the end and then the top until it makes a close fit. It is a good plan to make a *slightly* tapering fit, so that the inner face can just be entered into the opening. The taper must, however, be very small: not more than the thickness of a shaving. *B* in Fig. 14 shows the front at this stage. The inset shows in exaggeration the taper.

The sides follow, and, the bottom edges being planed straight, the ends are made square, both of exactly the same length. A gauge is set to slightly more than the width, and the top edges are planed until each side makes a hand-tight fit as shown in Fig. 15. The front edges should be marked *R* and *L*, so that there is no confusion when assembling. The back is treated similarly to the front, except that the

edges are square and it is narrower than the front. The reason for this is seen in Fig. 16, which shows how the back stands *above* the bottom and is set down slightly at the top.

It is usual for the bottom to rest in a groove in the drawer front, and it is necessary, therefore, for the bottom dovetail at the front to be low, so that the groove occurs *within* the dovetail; otherwise a gap will show at the ends. When glueing up, place a piece of wood over the joints and strike this so that the wood is not bruised, and to avoid splitting the corners. Test for squareness with the try-square and put aside.

When the glue has set, clean up the joints and fit the drawer. Make sure where the drawer sticks before taking off any shavings. The moulding is now glued in, and finally the bottom passed in from the back and screwed to the back. If solid wood is used, the bottom should be allowed to project about $\frac{1}{4}$ in. at the back, so that in the event of shrinkage it can later be pushed forward. This is unnecessary in the case of plywood. A good lubricant for drawers is candle-grease, but this should not be applied until after the work has been polished.

A Simple Method

In place of dovetails a simple lapped joint can be used at the front as in Fig. 17. It is not so strong as a dovetailed drawer, but it serves its purpose for a cheap job. The back fits in grooves. The preliminary fitting is the same as that already described, except that the back is cut short by an amount equal

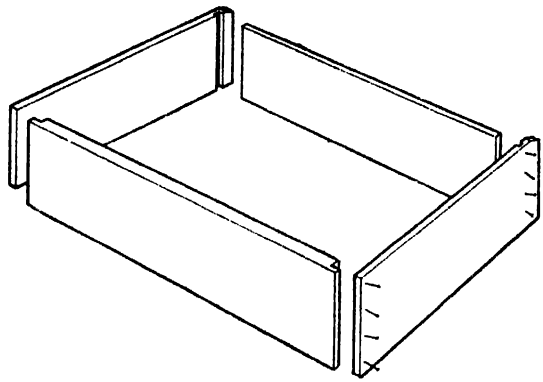


FIG. 17.—SIMPLE DRAWER CONSTRUCTION.
The front corners are lapped and the back ones grooved.

to the thickness of wood left at the bottom of the two grooves. Fig. 18 shows how the wood is marked

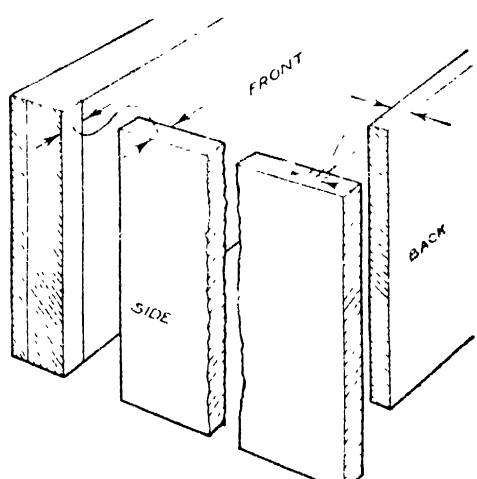


FIG. 18.—DRAWER CONSTRUCTION.
How parts are gauged when making simple drawer.

out with the gauge. To avoid grooving the front, the drawer bottom moulding can be fixed here as well as at the sides. The whole thing is put together with glue and nails, the last named being driven in dovetail fashion and punched in.

§3. HOW TO FIT A LOCK

There are two kinds of locks used in furniture: those requiring merely to be screwed on, and those which have to be let in. The latter kind are by far the better, because they are much neater, and they take up no space in the drawer, or whatever it may be. Some locks are made so that they can be used on either a drawer or a door, the hole for the key being cut in duplicate. Others are made specifically for the one or the other, and must be ordered accordingly. One other point is that a door may close on either right or left hand, and care must be taken to select the correct one. An example of a "left-hand" lock is given at *A*, Fig. 19. This could also be used for a drawer.

FIG. 19.—STAGES IN FITTING A LOCK.

A. Lock suitable for door or drawer. Note also escutcheon.
B. Setting gauge to pin.
C. Boring for escutcheon.
D. Tapping escutcheon to make indentation.
E. Sawing sides of keyhole.
F. Marking position of body of lock.
G. Preliminary sawing out.
H. Paring away waste.
I. Notch for lock completed.
J. Drawer lock chisel.

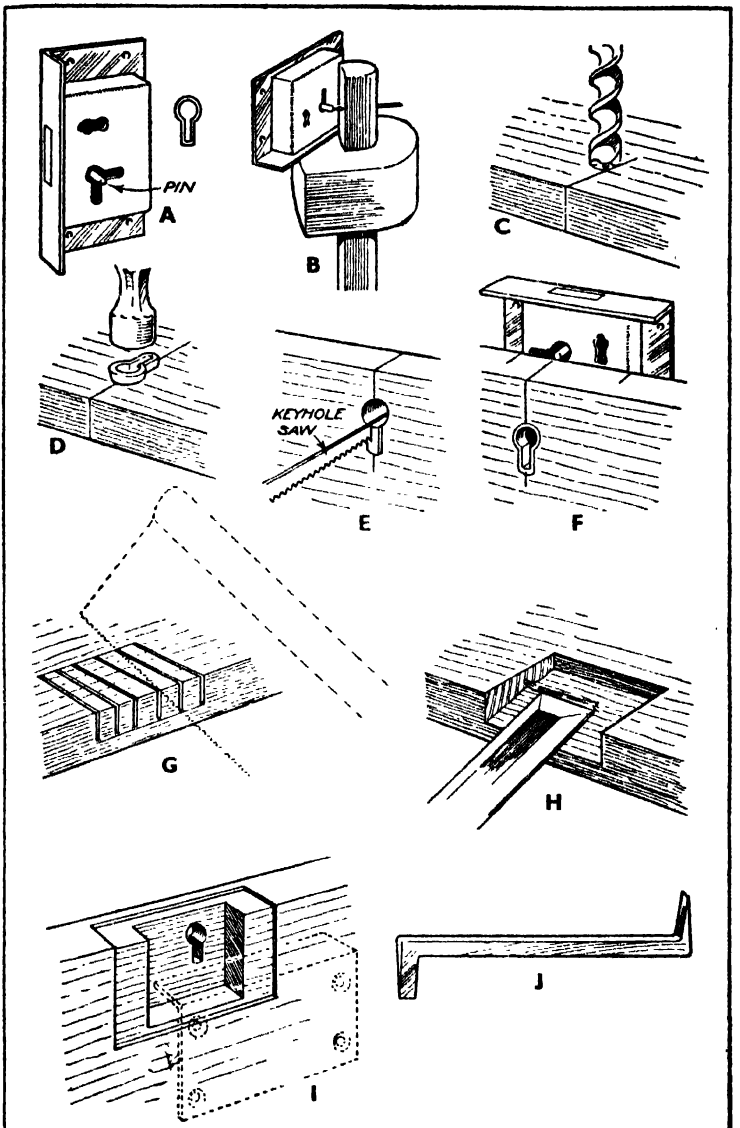


FIG. 19.

A Drawer Lock

First square down a line in the centre of the front from the top edge, and set a gauge to the centre of the pin of the lock from its top edge as at *B*. With it mark the front at the line. This gives the position of the pin. Select a bit which will make a hole slightly less in diameter than the top rounded part of the escutcheon, and bore right through the front as at *C*. Place the escutcheon in position and tap it lightly with the hammer so that it makes an indentation (*D*). Then, fixing the drawer on the bench, cut down the sides with the keyhole saw (*E*), and chisel away the waste. The escutcheon can be tapped in flush.

The next step is to mark where the wood has to be cut away to enable the body of the lock to be let in. This is done by holding the lock with the pin opposite the centre line (this is squared across the top edge) and marking the sides as at *F*. These lines are squared down inside, and a gauge is used to mark both the thickness and the depth.

When cutting away the waste, make a saw-cut at each line as at *G*, and a series of cuts between to cut up the grain. Cut down the sides with the chisel and pare away the waste as at *H*. This will enable the lock to be placed in position so that the outer plate can be marked round. Sometimes only the top part of the plate is let in flush, and this certainly saves time, though a much neater job results when the back is let in also. The sides are cut round with the chisel and the waste is carefully pared away.

When the screws have been driven in, the position of the mortise to allow the bolt to be shot home can be marked. This is done by smearing a little dark paste (such as the dirty oil from an oilstone) on the top of the bolt. The key is then turned and the drawer pushed right home. If the key is turned, the bolt will leave an impression on the upper rail of the chest. A drawer lock chisel is handy with which to cut the mortise. It is shown at *J*. Otherwise a short chisel or even a bradawl can be used.

When a box lock is fitted, the general procedure for fixing the lock is similar. To enable the link-plate to be fixed, it is placed in position on the lock. It will be found to have a couple of spikes at the top side, and by closing the lid and thumping it, the spikes will enter the lid and will rise with it when the latter is opened.

§4. HOW TO FIT HINGES

There are a great many varieties of hinges, each designed for a special purpose. The simplest kind is that intended to be screwed straight on to the door without being recessed, and these usually have a decorative shape to take off their crudeness. They are not, however, specially strong, because the whole weight of the door falls on the screws, and a much neater type is the butt hinge. This is intended to be recessed into the wood, so that the hinge, in resting in its recess, is supported to a large extent quite apart from the screws. These can be obtained in

sizes from $\frac{3}{8}$ in. up to 3 or 4 in., and in both brass and iron.

Similar in type is the back flap. The leaves are, however, much wider, being practically square, and they are used for such jobs as bureau falls. Another type, known as the *T* hinge, is used for outdoor work for hanging large doors. It does not require to be let in.

The Butt Hinge

The position in which a hinge is fixed depends upon the way the door is to be hung. For instance, at *A*, Fig. 20, the door closes *over* the sides of the cupboard, and in this case the hinge is recessed into the back of the door and the front edge of the side. At *B* the door is contained *between* the sides, and the hinges are let into the edge of the door and the inner side of the cupboard. One point to note here is that the outer or closing edge of the door must be taken off at a slight angle, as shown, as otherwise it will bind when opened. Whenever a single door is hinged, the hinges are fixed at the right-hand side, unless there is some special reason to the contrary. The usual way of hingeing a box is given at *C*, the hinges being let into the edges of both lid and box.

As a rule both leaves of the hinge are let in equally as at *D*, and, as most hinges when closed are thicker at the knuckle than at the outer edges, the extent to which they are let in is measured from the knuckle, because it is here that the whole pivoting takes place. In every case, then, the centre of the knuckle is worked to, both in the

depth and in the distance in from the edge. *D* shows how this centre lines up with both the outer faces and with the crack between the door and the cupboard.

In some cases it is an advantage to let the hinge wholly into the door as at *E*. Even in this, however, a sloping recess is cut in the cupboard, so that the

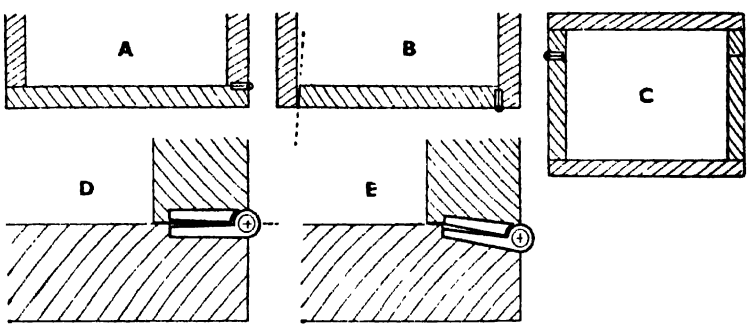


FIG. 20.—SECTIONS THROUGH HINGED JOINTS.

A. Door closes over cupboard sides.
B. Door contained between sides.
C. Box hinge.
D. Hinge let equally into door and cupboard.
E. Hinge let wholly into door.

edge of the leaf is let in. This not only makes a neater finish, but also strengthens it. Note that only the edge is let in (*E*) : the knuckle simply rests on the surface.

Fitting the Hinge

Assuming that the hinges of a door are to be let in equally in both leaves, the first step is to mark the positions in which they are to be fitted. As a general guide, they can be fixed their own length

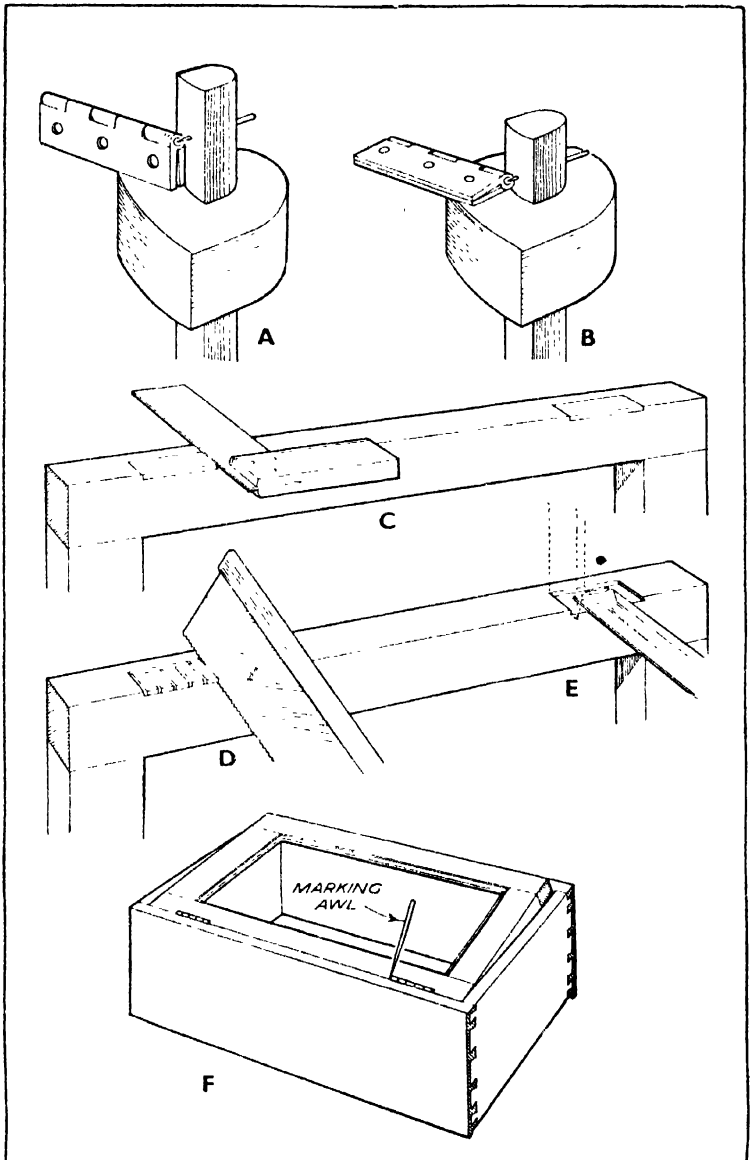


FIG. 21.

from the end of the door, though this may have to be varied in special circumstances. Place the hinge in position and mark both ends with a pricker or sharp pencil, and square the lines across, as at *C*, Fig. 21.

The depth and distance in from the edge are now gauged If two gauges are available, it is an advantage, so that they can remain set for marking the cupboard. Otherwise re-setting will be necessary. *A* and *B*, Fig. 21, show how the marker points to the centre of the pin in both cases. Mark both the edge and face of the door, taking care not to over-run the marks.

With a fine saw cut each line and make a series of cuts between as at *D*, Fig. 21, so that the grain is cut up short. Now tap the chisel downwards at each end (see dotted lines at *E*, Fig. 21), also at the back, placing the chisel just inside the gauge line. The waste is pared away, and a final cut made right on the gauge line. When the bottom is quite smooth, fix the hinge with a couple of screws only.

To transfer the marks to the cupboard, place the door in position as at *F*, Fig. 21, and mark with a marking-awl or sharp pencil. The recesses are cut and a single screw is driven into each hinge. If any adjustment is needed when the door is closed, a

FIG. 21.—STAGES IN FITTING BUTT HINGES.

A. Gauge set to depth.
B. Setting gauge to thickness.
C. Squaring in position of hinges.
D. Preliminary sawing.
E. Chiselling recess.
F. Transferring marks to cupboard.

screw can be driven into another hole. The general rule is to put in all remaining screws after the whole has been polished.

§ 5. VENEERING

Veneering is not difficult to do, and does not call for much in the way of special appliances, but it is essential that the work is done properly if the result is to be a success. The groundwork must be sound and be properly prepared. Solid, straight-grained mahogany or American whitewood, is the ideal ground. Deal is not suitable, because the resin in it prevents the glue from gripping well, and it is liable to soak up too much of the glue. If it is used, a best-quality grade free from knots should be selected, and, to seal the grain, it should be sized with glue thinned down with water. Size should also be used when end grain is veneered, though this is never a very satisfactory thing to do.

An excellent material is laminated board. Plywood, too, gives good results if a good grade is selected. A poor quality is useless, because there are invariably internal faults which eventually show through to the surface. The veneer should be laid with its grain at right angles with that of the ply, otherwise cracks may develop.

The Pull of Veneer

Veneer always tends to pull the groundwork hollow. Consequently the ideal arrangement is to veneer both sides so that the pull is equalised. For

such a piece of work as a flush door this is really essential, because there is no supporting framework.

When the veneer is to be laid on one side only it should be put on the heart side of the groundwork. Fig. 22 explains this. A board, if it is going to twist at all, tends to pull so that the ends turn away from the centre of the log, this being due to the main shrinkage taking place around the annual rings. If, therefore, the veneer is laid on the heart

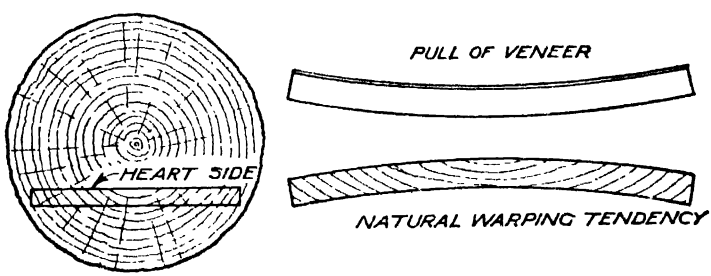


FIG. 22.—HOW PULLING TENDENCY IS MINIMISED.
The warping tendency is opposed to the pull of the veneer, the latter being laid on the heart side.

side, the forces are opposed as shown. Another precaution is to damp the groundwork on the underside when veneering.

The simplest method of veneering is the hammer method as it requires little in the way of apparatus.

The groundwork is first prepared by planing it dead true. To remove the plane-marks and to roughen the surface to form a key for the glue, a toothing-plane is then worked over the entire surface diagonally, first in one direction and then in the other as shown in Fig. 23. The cutter of this

toothing-plane is practically upright, and is scored so that the " edge " presents a series of sharp points. If a plane is not available, a piece of the coarsest glasspaper can be wrapped round a flat block of wood, care being taken not to dub over the edges. If the groundwork is of softwood, it is then sized and

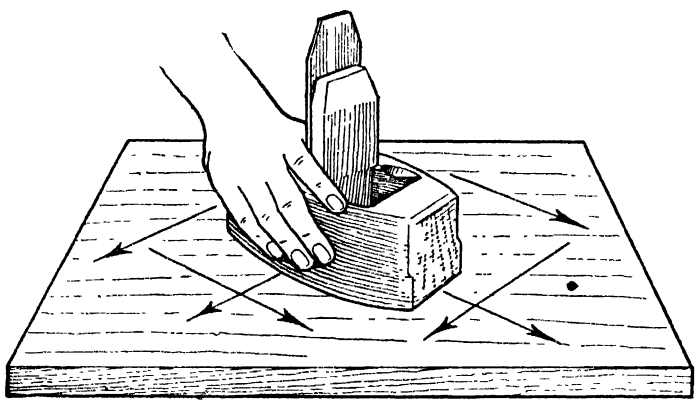


FIG. 23.—USE OF THE TOOTHING-PLANE.
It is worked diagonally, first in one direction and then in the other.

set aside to dry. All dust must be carefully brushed away.

The veneer is next cut to size, and, assuming that it has to cover the entire groundwork, it is cut about $\frac{1}{2}$ in. full all round. A chisel can be used for cutting, the veneer being pressed down on to a flat board with a straight-edge as shown in Fig. 24.

The glue must not be too thick. When thoroughly warm it should run down freely without breaking into drops from the brush when the latter is held a

few inches from the pot. Apply the glue to both the veneer and the groundwork, and place the former in position, smoothing it out with the hands. It

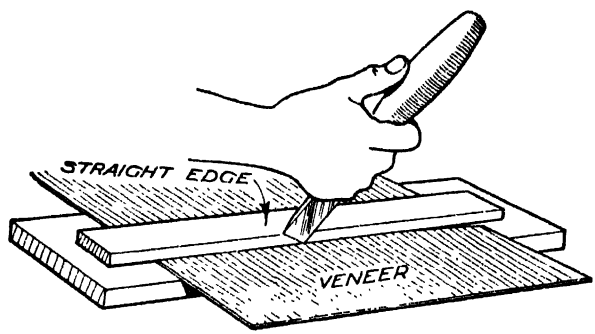


FIG. 24.—CUTTING VENEER WITH CHISEL.

does not matter if the glue chills during the operation.

To heat the glue an ordinary domestic flat-iron is used. Do not make it too hot. It should give

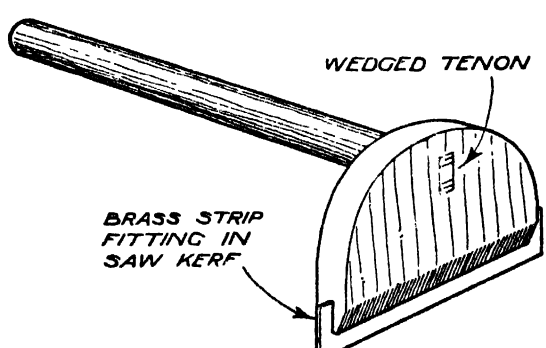


FIG. 25.—DETAILS OF VENEERING HAMMER.

The brass strip can be from 5 to 6 in. long, and about $\frac{1}{16}$ in. thick. The handle is about 9 in. long.

just a comfortable warmth when held a few inches from the cheek. With a swab damp about one-half of the veneer. This is to prevent the veneer and

FIG. 26.—PRESSING DOWN WITH VENEERING HAMMER. It is worked from the centre outwards so that the glue is squeezed out at the edges.

glue from being scorched; but avoid a surplus of water. Pass the iron over the surface, and then proceed to press out the glue with the veneering hammer (see Fig. 25), working the latter with a

zig-zag movement from the centre outwards. The hammer is shown in use in Fig. 26.

When the one half has been completed, the other can be dealt with similarly. To test whether the veneer is properly down, tap the surface with the finger-nails. It should give a solid feeling. Wipe

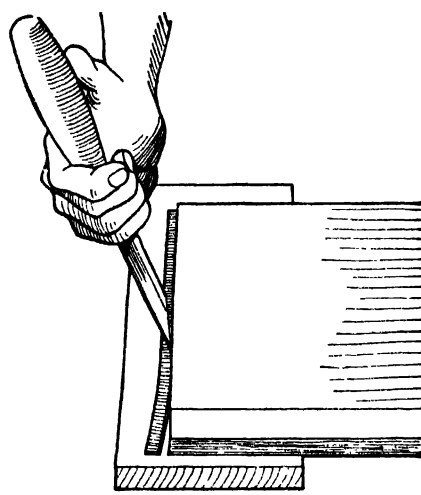


FIG. 27.—TRIMMING EDGES.

The work is placed veneer side down on a flat board and is pressed well down.

off any surplus glue with the swab and cut off the overhang by turning the whole thing upside down on a flat board and cutting round with a chisel. The groundwork must be pressed tightly down. This is shown in Fig. 27.

Allow plenty of time for the glue to set—at least 24 hours. A scraper is used for cleaning up, after

which glasspaper is used, first Fine 2 and then No. 1½.

Sometimes in a wide piece, or when two pieces are being matched, a joint has to be made. First lay the one piece, and then the other so that it overlaps the first by about ½ in. Place a straight-edge along the overlap, fix it with a couple of thumbscrews, and make a single cut right the way along as in Fig. 28

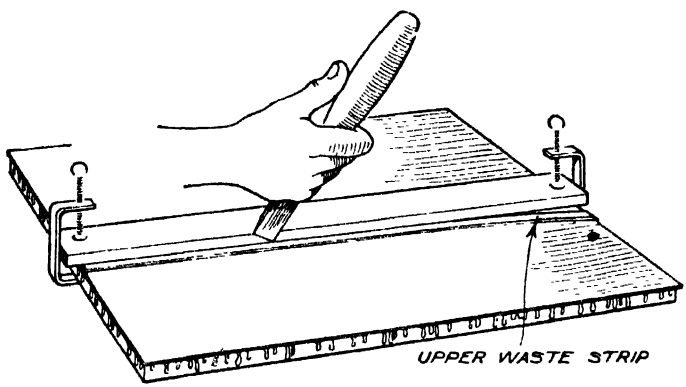


FIG. 28.—MAKING A JOINT IN VENEER.
The chisel cuts through both thicknesses.

so that both thicknesses are cut through. Remove the straight-edge and peel away the one piece of waste. To get at the other, the veneer must be raised as shown in Fig. 29. It is then heated and rubbed down finally, a piece of gummed tape being stuck over the joint to prevent it from opening as the glue dries out.

When a panel is to be cross-banded around the sides, the main part of the veneer is cut a trifle small, and, after laying, a cutting-gauge is set to the width

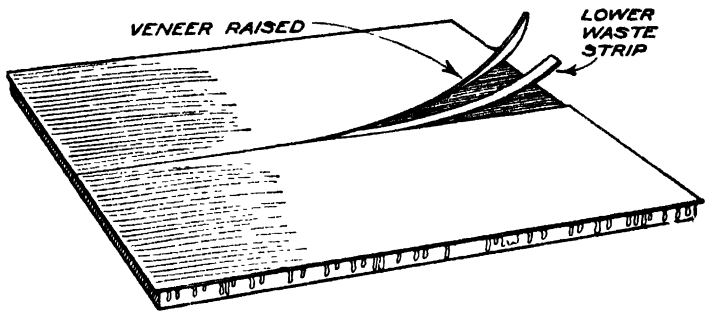


FIG. 29.—JOINTING IN VENEER.
The veneer is raised to allow the lower waste strip to be peeled away.

of the banding and is worked all round. The waste is then peeled away as shown in Fig. 30. The

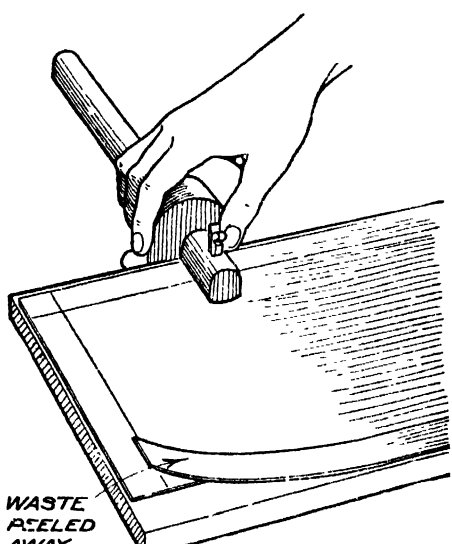


FIG. 30.—LAYING CROSS-BANDING.
Gauging around edges and removing waste

veneer for the banding can also be cut with the cutting-gauge set a trifle full. The edge is first planed on the shooting-board as shown in Fig. 31, a straight-edge being pressed down on top to prevent buckling. The gauge can be used first from one side and then from the other.

When laying the cross-banding, any jointing, such as the corner mitres and butt joints in the length,

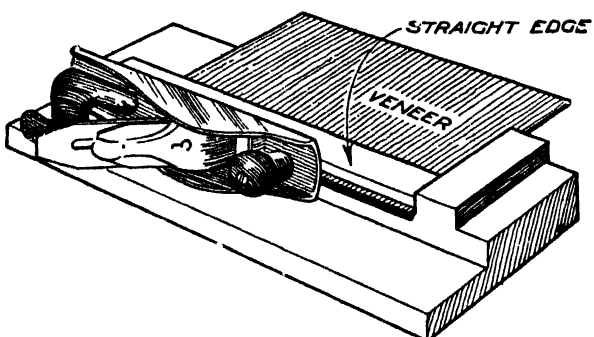


FIG. 31.—TRIMMING EDGES OF VENEER.
The straight-edge or batten prevents the veneer from buckling.

is done as the work proceeds. The pane of an ordinary hammer can be used for rubbing down. Gummed tape is stuck over all joints. When cleaning up a cross-banded panel the scraper should be held at an angle, so that there is less tendency for the grain to tear out.

§6. WOOD FINISHING

A finish of some sort is desirable on any piece of woodwork, partly because bare wood rapidly becomes

soiled with use, and partly because a polish serves to seal the grain.

Sometimes the polish is applied directly to the wood, but more often it is first stained. There is a tendency nowadays to eliminate the staining, and if the same kind of wood is used throughout, the result is quite successful. Sometimes it happens that different kinds of, say, oak have been used, and the tone thus varies. In this case a stain is desirable so that the whole tones down to a common shade.

One form of finish generally known as a varnish stain has the effect of colouring and giving a shine in one operation, but it is not recommended for good work, because the colouring matter is contained in the varnish and has the effect of hiding the grain.

Stains

There are many excellent proprietary stains on the market and the reader cannot do better than use these. Instructions on their use are supplied with the stains, and these should be followed implicitly. Some in particular are of an oily nature, and it is imperative that plenty of time is allowed for them to dry out thoroughly before any polish is applied. Otherwise there may be trouble owing to the polish not drying, or to the oil soaking through and causing it to become dull.

Stains can also be made up by the reader himself. Aniline dyes give good results, and various shades can be mixed together to produce any special colour. They are in powder form, and can be obtained

soluble in either methylated spirit or water. A thorough mixing is essential, and they should be allowed to stand for several hours before use. A little french polish can be added to the spirit stain to act as a binder. The spirit stain is not so liable to raise the grain as the water variety.

A cheap stain can be made from Vandyke crystals. These are dissolved in warm water, the amount depending upon the shade required. A little glue size is added while it is still warm to bind it. It gives a medium brown shade. Another good stain is made from Asphaltum. This is dissolved in turpentine and, after straining, a little gold size is added. It gives a brown shade which is useful for imitating oak or walnut, and is of value chiefly for deal.

Oak is best darkened by fuming, because, since no liquid is applied, the grain is not raised. The work is placed in a cupboard with a close-fitting door, and the ammonia (known as "point eight eighty") is poured into a saucer. The time it remains in the cupboard depends upon the shade required and the size of the cupboard. It may vary from fifteen minutes up to several hours. Great care must be taken not to bend over the ammonia, because the fumes are very strong. The work is best done out in the open. Since some varieties of oak are more susceptible to the fumes than others (American oak is scarcely affected), it is important that the same kind of oak be used throughout.

Alternatively, any of the proprietary stains can be used, or those made up with aniline dyes. Per-

manganate of potash is sometimes used, but it is not permanent, the colour gradually changing in the course of time.

An excellent plan for mahogany is to use bichromate of potash, which darkens the wood by chemical action rather than by staining. This is in crystal form, and the crystals are placed in water. The latter will gradually turn a reddish-orange shade. It is applied to the wood by daylight and allowed to dry out. The wood will turn a brown shade free from the objectionable reddish shade often seen in mahogany furniture. A yellowish dust is left on the surface, and this is wiped off before polishing. Aniline dyes or proprietary stains can also be used. Walnut is usually best left without staining, though any of the marketed stains or aniline dyes can be used.

It is inevitable that water and spirit stains will raise the grain to a certain extent, and to minimise this the work should first be damped with water and allowed to dry. The surface can then be glass-papered smooth. When the stain is applied, the grain will rise to a small extent only.

Brushes are needed for staining, also a rag. The stain is applied *with* the grain, and the edges should be kept alive so that patches are avoided. To get rid of brush-marks the rag is soaked in the stain, wrung out, and wiped over the surface in long, even strokes. When staining a piece of panelling such as a door, the panels should be stained first. Start at one side, not the middle, so that there is only one edge to keep alive. Now stain the framing, carrying

the stain cleanly up to the joints of the horizontal rails, and finishing off at the uprights as shown in Fig. 32. The mouldings are picked in lastly with a small brush. Generally it is better to give two weak coats of stain rather than one strong one. The first must dry out thoroughly and be lightly glass-papered smooth before the second is applied.

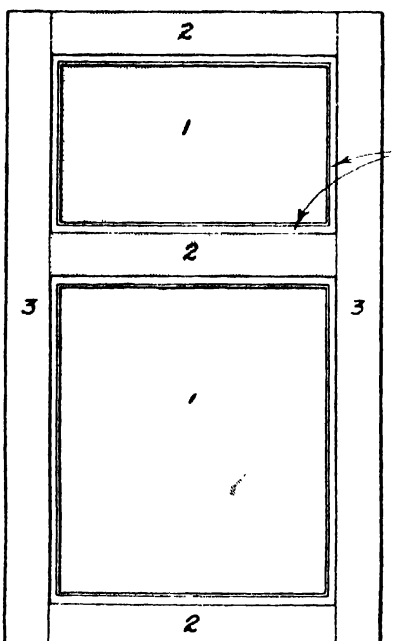


FIG. 32.—STAINING A DOOR. Figures show order in which parts should be stained.

One point to note (and this applies equally to polishing) is that when possible the parts should be separated. For instance, panels are more easily dealt with before being fixed in the framework. If this is not possible, the edges should be stained before fixing, so that in the event of shrinkage there will not be any white gaps as the panel draws out of the grooves.

If for any reason a part of the work is of too dark a shade, it can be bleached with oxalic acid. This is a powder, and it is dissolved in warm water, about 1 oz. of acid to half a pint of water. It is applied to the work, several times if necessary. Sometimes

a swab soaked in the acid can be left on the work if the dark patch is local. Afterwards it should be well washed with water to get rid of the acid, as the latter may have a bad effect upon any polish to be applied later. As the acid is a poison, care should be taken to wash the fingers afterwards.

Some proprietary stains have preservative qualities which make them specially useful for outdoor woodwork, and these should certainly be used for jobs liable to be exposed to the weather. For floorboards the Vandyke crystals already mentioned are suitable, and have the advantage of cheapness. If the floor is not new it should be washed thoroughly first with warm water in which a few lumps of soda have been dissolved to get rid of any grease.

Wax Polish

A polish which dates back for centuries and which has recently become popular is wax polish. It gives a somewhat dull, eggshell finish which looks especially well on oak and walnut. It has two great advantages: it is inexpensive and is easy to apply.

Two kinds of wax are available, yellow and white, and the reader can decide which is the more suitable for his purpose. For a light wood which is to be kept as light as possible the white is the better. It should be shredded into a tin, just covered with turpentine, and allowed to dissolve. The process can be quickened by standing the tin in hot water. Never place it over a flame; it will inevitably flare up. When ready it should be in the form of a paste of thin consistency, and is applied either with

a brush or a rag. The brush is handy for working into corners and dealing with carved work.

The wood must be quite dry, and, in the event of its having been stained with an oil stain, plenty of time should elapse before the wax is applied. It is a good plan to rub over the surface with a rag to remove any traces of oil. At least twenty-four hours should be allowed for the turpentine to evaporate, after which the whole can be polished with a rubber free from fluff. Probably the first application will not produce much of a shine, but the advantage of wax polishing is that it can be repeated at any time.

French Polish

This is a job calling for considerably more experience than wax polishing, and the reader is advised not to make a good piece of work his first effort. It is far better to practise on a spare piece of wood.

The first step after the wood has been stained is to fill in the grain. Proprietary fillers can be obtained, and they give excellent results. Alternatively, a filler can be made from whiting. This is dried and a little powder colour added to take off the whiteness. Rose-pink is suitable for mahogany and umber for oak or walnut. This is mixed in thoroughly and turpentine added a little at a time to bring it to a paste. The addition of a little gold size helps, as it acts as a binder. The filler is applied with a rag across the grain so that the pores are well filled in, and allowed to stand until it becomes tacky. The surplus can then be wiped off the surface.

Special care must be taken to clean out corners, mouldings, and so on, and a little piece of stick is handy for this.

The work is set aside to harden, and then smoothed with fine, worn glasspaper. In all stages of french polishing allow plenty of time between each process. This is one of the secrets of successful polishing. A rag dipped in linseed oil is now worked over the surface and it is once again allowed to dry out. The effect of this is to kill any whiteness in the filler, but it *must dry out thoroughly*. Several days should be allowed if possible.

A piece of flour-grade glasspaper is next rubbed over the surface to remove any filler and to smooth it. The necessity of wiping off the surplus in the preliminary filling is appreciated at this stage. The french polish can be obtained ready made, or it can be made up as follows. In a pint of methylated spirit dissolve about 7 oz. of orange shellac (or bleached shellac if a white polish is required). This will take some considerable time, and to speed it up the bottle should be frequently shaken.

The rubber is made up of a little wad of cotton wool with the skin removed. It is charged with polish and moulded into a pear shape. A piece of fine muslin is used to cover it, and it should be so wrapped round it that the sole is free from all creases. Every time the rubber needs re-charging the cover should be taken off, the cotton wool placed over the top of the bottle, and the latter inverted. The rubber should exude a *little* polish when pressed, but on no account should it be too

fully charged. It is not the amount of polish applied that produces the shine, but the work put into the rubbing.

In the opening stages the polish can be applied a little more generously, because it is bound to soak into the grain. Work the rubber with a circular motion, taking special care at the corners. Polishers have a saying that if the corners are attended to the middle will take care of itself. Work out the rubber

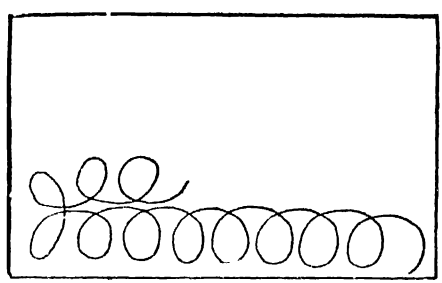


FIG. 33.—FRENCH POLISHING.
The circular path of the rubber when bodying up.

until it is dry, and then go over another part of the job. It is always an advantage to polish several articles at the same time, because some can be hardening whilst others are being dealt with.

After a couple of hours or so the surface is rubbed lightly down with the finest worn glasspaper. Two pieces can be rubbed together to take off the cut of the new glasspaper. Now give a second coat of polish, continuing the circular motion as shown in Fig. 33, and work the rubber until it is practically dry. If it begins to drag, a single spot of linseed oil

can be applied to the sole with the finger. Avoid too much oil, however, because it prevents a high gloss, and it has all to be worked out later. Once again set the work aside and proceed with another part of the job. The time allowed between the successive rubbings is most important.

Proceeding in this way a good body will gradually

FIG 34.—HOW FRENCH-POLISHING RUBBER IS HELD. It should be moulded to a pear shape.

be built up. One of the secrets is in knowing just when to stop and leave the work to harden, and this is a thing which comes only with experience. If the rubbing is continued too long the rubber will begin to drag off the polish already applied. When a fair shine has been attained the circular movement is changed for long, even strokes *with* the grain.

Before the application of each coat rub the surface down with the worn glasspaper.

The final stage is known as spiriting off, and it is one which requires the utmost care. Make a fresh rubber and sprinkle on the cotton wool a couple of drops of methylated spirit—no more. Work this well into the cotton wool so that it is evenly distributed, and, wrapping round the cover, work it along the surface in long, even strokes. The object of this is to remove all traces of oil and to burnish the surface. After a few rubs the sole of the rubber will be greasy with oil and the cover should be moved so that a fresh, clean part covers the sole. Work the rubber until it is quite dry, and if the process has been done properly a brilliant shine will be the result. When the polish has hardened the process can be repeated. Note that only the slightest trace of spirit should be used. If the rubber is really damp it will drag off the polish and ruin the work.

Fig. 34 shows how the rubber is held. A pear shape allows a pointed corner at the front which will work into the corners. When finished with for the night, rubbers should be kept in an air-tight tin.

§ 7. NEW FINISH

A finish widely used today is known as rubbing varnish. It is brush-applied, and when really hard is rubbed down with a fine-grade silicon-carbide abrasive paper lubricated with soap. Finally, it is burnished with one of the modern motor-car polishes which contains a superfine abrasive.

CHAPTER IV

OUTDOOR WOODWORK

§ 1. WORK BENCH

An essential feature of a bench is that it is rigid and able to stand up to the racking strains it is necessarily subjected to. The top too must be firm and thick enough to resist bending, and solid so that it can stand up to heavy chopping work, such as

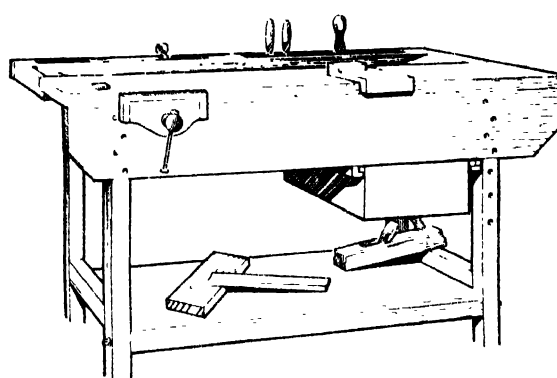


Fig. 1.—Useful Bench with Well Top and Drawer and Shelf Accommodation.

mortising. The height may have to be adapted to suit the stature of the individual user; 2 ft. 9 in. is about right for the average man. Length may be a matter of the space available, but it should be as long as is practicable. Depth too is a matter of convenience. Again make it as large as space will allow.

The well-type top is recommended, because it enables the many small tools in constant use to be

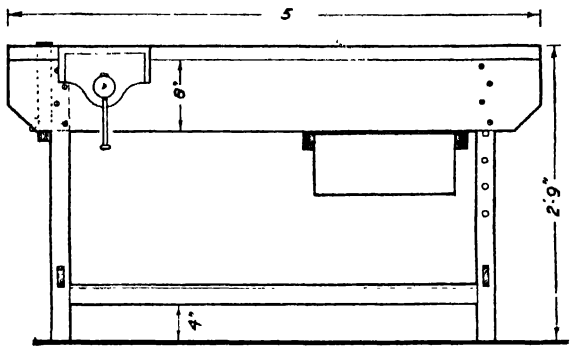


FIG. 2*a*.—FRONT ELEVATION.

left in the well, where they are handy. A metal vice is fitted, and an adjustable stop is incorporated at the head, this being held by a wing nut tightened

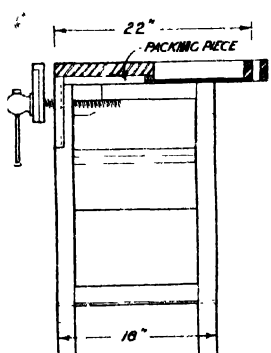


FIG. 2*b*.—SIDE ELEVATION.

over a washer. The wide front rail (generally called the apron piece) has two advantages. Being grooved to fit over the legs, it effectually prevents side racking

and enables a thinner top to be used, as it resists bending strain. Big tools and appliances can be kept on the large shelf, and small ones in the drawer. The latter should not be fitted with a stop to prevent its being pulled right out, because for some jobs it is desirable to remove it.

Fig. 2 gives the main sizes and Fig. 3 the method of making the main framework. The two end frames are put together with through mortise-and-

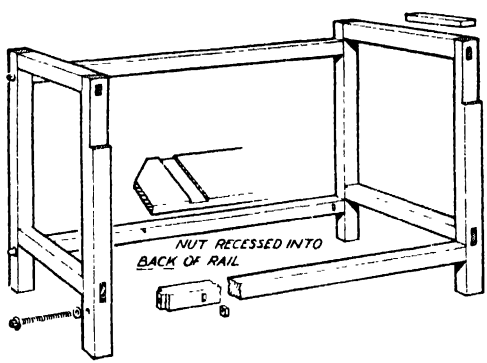


FIG. 3.—DETAILS OF CONSTRUCTION.

tenon joints, these being wedged from outside. Top back and both bottom rails have stub-tenons to fit into the legs, and long bolts are passed right through to engage with nuts let into the rails, as in Figs. 3 and 4, so that the whole is held tightly together. It also enables the whole thing to be taken down and stacked if it is necessary to store the bench at any time.

Begin by making the two end frames. Use a hardwood if possible, such as beech or oak. Squares of 2-in. section can be obtained and require only to be

planed true. To make sure that all are marked alike, they should be fixed together side by side temporarily and the mortise positions squared across all. Those for the top side rails are at the extreme tops of the legs, and the lower ones stand up $6\frac{1}{4}$ in. from the floor. As the tenons pass right through, the marks must be squared round to the opposite faces. Additional marks are squared across at the outside about $\frac{3}{16}$ in. outside the other lines. The mortises are sloped back to these outer lines so that the wedges when driven in cause the tenons to have a dovetail grip.

Note that the blind mortises for front and back rails are below those for the sides, a gap of $\frac{1}{4}$ in. being left between the two so that the shelf of $\frac{1}{4}$-in. ply can fit *beneath* the side rails but *above* those at front and back. Mortises for top back rail are immediately below those for the top side rails.

Glue up the end frames independently, cramping them and driving wedges into saw cuts made in the tenons (Fig. 4). Level the joints when the glue has set and cut back the front legs at the top (Fig. 3). The mortises for front and back rails are about $\frac{3}{4}$ in. deep only. The length of the tenons is slightly less than this. The fit should be hand-tight, and the parts should be held together temporarily with a cramp and a hole bored through from outside right into the tenon and about 3 in. into the rails. Use a $\frac{3}{8}$-in. bit for $\frac{3}{8}$-in. bolts. At the back of the rail a recess is cut to take a nut. This recess must obviously be in line with the bored hole, and in size it should allow the nut to go in freely without being

able to turn round. Obviously the bored hole must extend well beyond the notch so that the bolt, having engaged the nut, can pass well beyond.

Having fitted the rails into the legs, the apron rail is fitted, this being grooved at the back as in Fig. 3 to fit over the cut-back part at the top of the legs. Fix with four stout screws at each leg. Note, how-

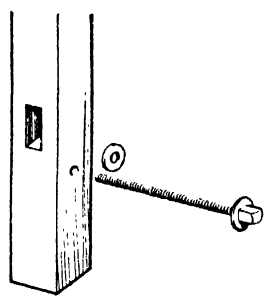


FIG. 4.—HOW BOLTS HOLD FRONT AND BACK LEGS TO RAILS.

ever, that it stands up beyond the top of the legs by the thickness of the packing piece (Fig. 2, side section, and Fig. 5). This latter is decided by the depth of the well at the back of the bench in relation to the thickness of the top.

The whole thing being put together, the shelf can be fitted, the corners being cut to fit around the legs. The parts can then be separated and the shelf slipped in. The main top should preferably be 1½ in. thick and in hardwood, but thinner stuff can be used if necessary. To form the well a piece of ¼-in. ply is screwed beneath the main top with a strip sandwiched between, as in the side section, Fig. 2. A ⅞-in. backing is screwed up from beneath, and a tool

rack is screwed on at the back, this consisting of a ½-in. strip with distance pieces between. The ends are filled in with sloping, wedge-shaped pieces, these having the advantage of enabling the well to be cleaned out easily. Fix with screws driven upwards through the end rails, and with recessed screws passed downwards through the top into the apron piece.

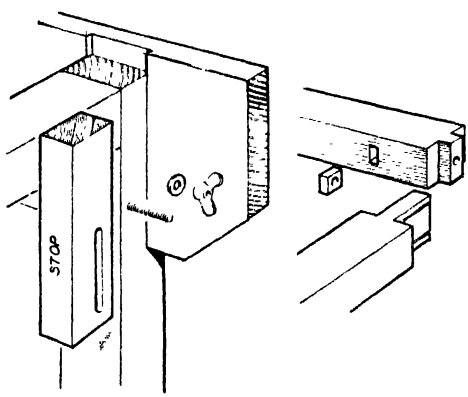


FIG. 5.—METHOD OF FITTING STOP.

A stop is fitted as in Fig. 5. It is simply a block of about 1½ in. by 1 in. passed tightly through a hole in the top. A bolt passed through the leg engages with a slot in the stop, this allowing the stop to be moved up or down. A wing nut tightened over a washer holds the stop in any desired position.

Vice fitting depends upon the particular make. It involves cutting away the front of the bench, and in all probability a packing piece will be needed beneath. Wood jaws must be fitted to the metal vice. Holes bored into the right-hand leg take a peg to support

long pieces held in the vice. The drawer can be a plain box, either dovetailed or lap-jointed together, with the bottom held in grooves or a slip moulding. Strips fixed to the sides at the top edges engage with L-shaped runners fixed beneath the apron piece. At the back uprights can be dropped down from the back rail to support the runners.

CUTTING LIST

	Length	Width	Thickness.
4 Legs	2 ft 0 in.	—	2 in. sq.
4 Rails	1 ,, 6½ ,,	—	2 ,,
3 Rails	4 ,, 0 ,,	—	2 ,,
1 Apron	5 ,, 0½ ,,	8¼ in.	⅞ in.
1 Top	5 ,, 0½ ,,	11¼ ,,	1½ ,,
1 Well bottom	5 ,, 0½ ,,	12¼ ,,	¼-in. ply
1 Back rail	5 ,, 0½ ,,	2¼ ,,	⅞ in.
1 Rack rail	5 ,, 0½ ,,	2¼ ,,	½ ,,
2 Sloping ends	6 ,,	10¼ ,,	2 ,,
1 Shelf	4 ,, 2½ ,,	18¼ ,,	¼-in. ply
1 Drawer front	1 ,, 4¼ ,,	7¼ ,,	⅞ in.
1 Drawer back	1 ,, 4¼ ,,	7¼ ,,	⅜ ,,
2 Drawer sides	1 ,, 4¼ ,,	7¼ ,,	⅜ ,,
1 Drawer bottom	1 ,, 3½ ,,	15½ ,,	¼-in. ply
1 Stop	1 ,, 0 ,,	⅝ ,,	1 in.

§ 2. SPAN-ROOF GREENHOUSE

10 ft. by 7 ft. approx.

This makes a handy size of greenhouse for the average garden, but could be slightly enlarged or cut down to suit special circumstances. Exact sizes are largely fixed by the pane width of the glasses. This is 12 in., which enables a standard size of glass to be cut economically. To take this the actual rebate

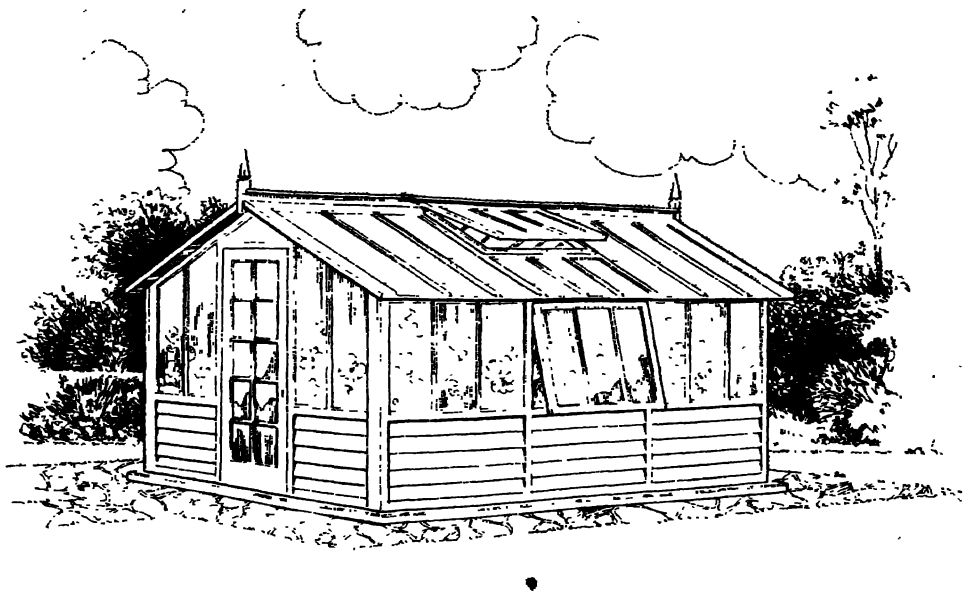


FIG. 6.—ATTRACTIVE GREENHOUSE, 10 FT. BY 7 FT. APPROX.

clearance width is $12\frac{1}{8}$ in., so that there is an easy fit and allowance for a bed of putty.

The whole thing is made up from two side frames, two end frames, and the roofs. These are bolted together so that they can be taken apart if it is

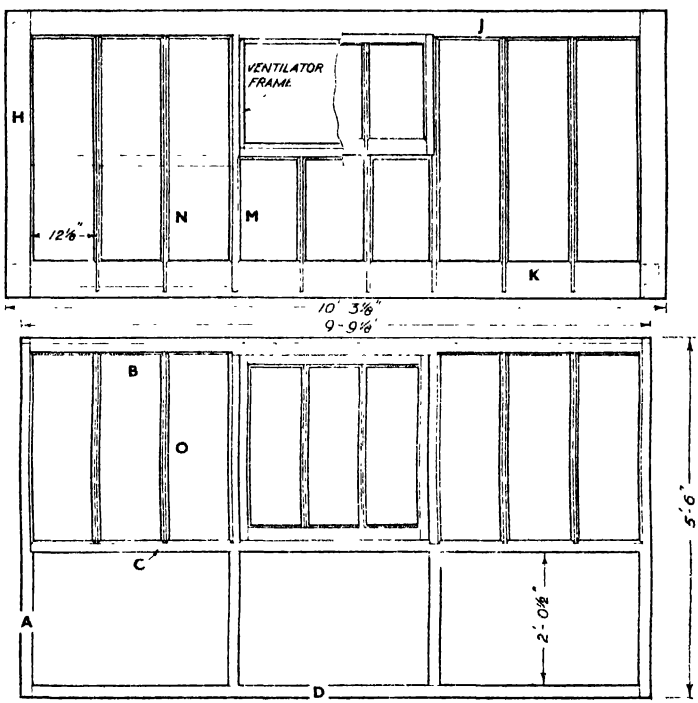


FIG. 7.—ROOF DETAIL AND ELEVATION OF SIDE.

required to move the house. A concrete or brick footing is essential to keep the wood away from the ground, where it is liable to rot. This footing need only extend an inch or so each side of the frames, because it will probably be desired to grow plants in the actual soil beneath the house.

Make up the side frames as in Fig. 7. One can be fitted with a window hinged at the top, and the other left plain or also fitted with a window. Details of the sections of the various main framework parts are shown in Fig. 10, from which it will be seen that the rebates for the glass are required in some portions

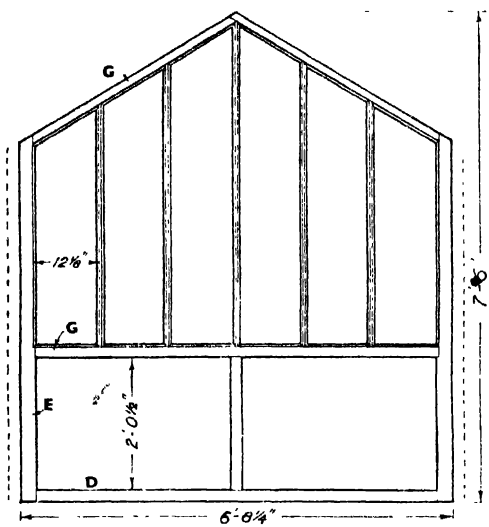


FIG. 8.—ELEVATION OF CLOSED END.

but not all through. Joints are needed as in Fig. 11, and it will be seen that complications are avoided by cutting mitres on the laps formed by the rebates. Remember that the shoulder length is therefore taken to the rebates on such parts. As the rebate is $\frac{1}{2}$ in. throughout, the shoulder length of top (*B*) and middle (*C*) rails is 1 in. longer than that of the bottom rail (*D*).

Mark out the mortise positions on the uprights (*A*) and gauge in where the rebates are to be worked. The mortises can either be taken right through and the tenons wedged at the outside, or they can be blind, in which case the joints should be pegged. Through mortising is rather stronger, but it leaves

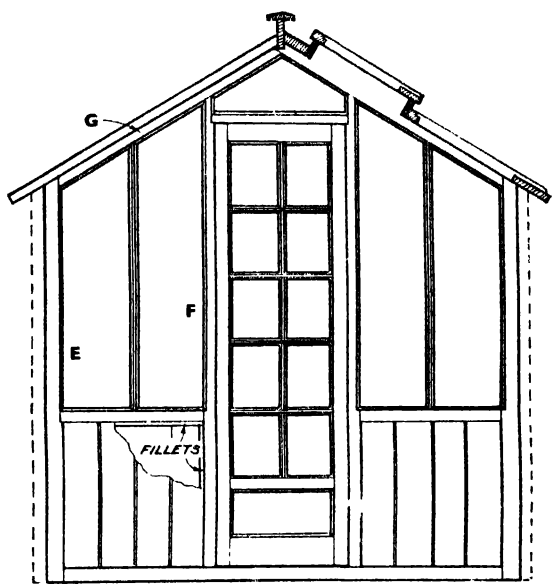


FIG. 9.—DOOR END ELEVATION.

the tenon ends exposed, always a weakness, in that end grain is where rot begins, and the wedges are liable to drop out in time, again allowing moisture to penetrate.

To enable the stopped rebates to be worked, chop a short portion with the chisel right up to the stop. The main part of the rebate can then be worked with

the rebate plane. Saw the tenons and cut the shoulders and mitres. The top rail (*B*) has to be bevelled at the top to agree with the slope of the roof, and this can be done before assembling. If a

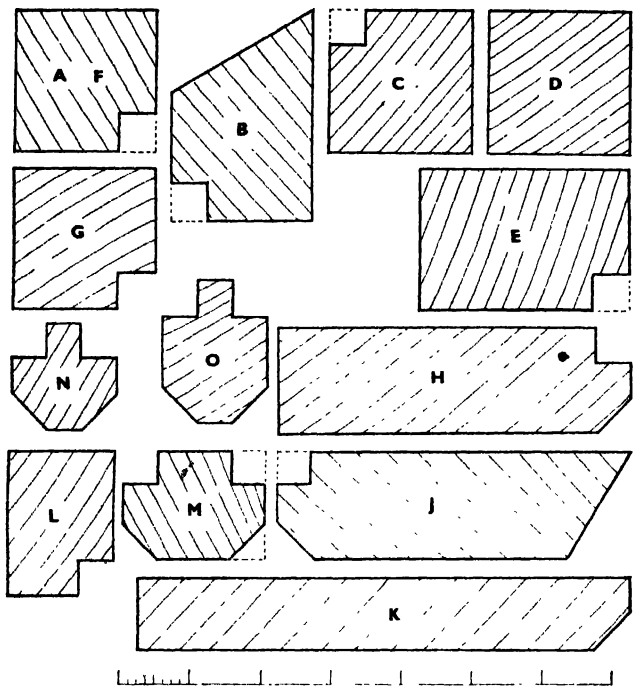


FIG. 10.—SECTIONS OF VARIOUS MEMBERS WITH SCALE.

circular saw is available this is the easiest way of cutting.

End frames are shown in Figs. 8 and 9, and it will be seen that construction is similar but that the sloping top members are fitted with open mortise-and-tenon joints as in Fig. 12. Here it is advisable

to use an adjustable sliding bevel to mark the joint, or nail two pieces of wood together at the required angle for marking. At the apex an open mortise-and-tenon joint is used again.

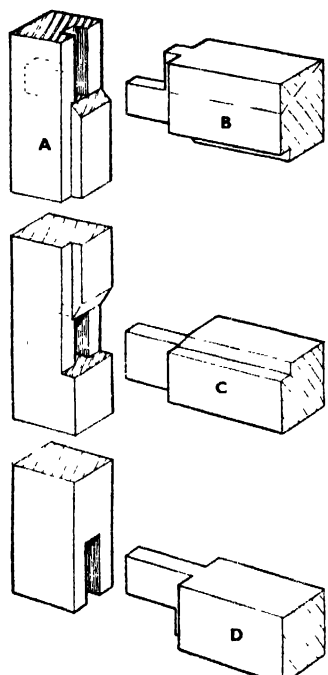


FIG. 11.—JOINTS USED IN SIDE FRAMEWORK.

Mortise positions for the bars can be marked in, noting that they will have to slope at an angle on the sloping members (*G*). For the shoulder length of the bars, however, it is advisable to put the main structure together temporarily to enable exact measurements to be taken. Standard bar stuff already rebated and moulded or chamfered can be

obtained. All frames should be assembled with either resin glue or with thick paint. If the latter is used the joints should be pegged if they are not being wedged. Test each frame for squareness when assembling and nail a batten across temporarily to hold the whole until the glue has set.

When erecting the structure fix one side to an end

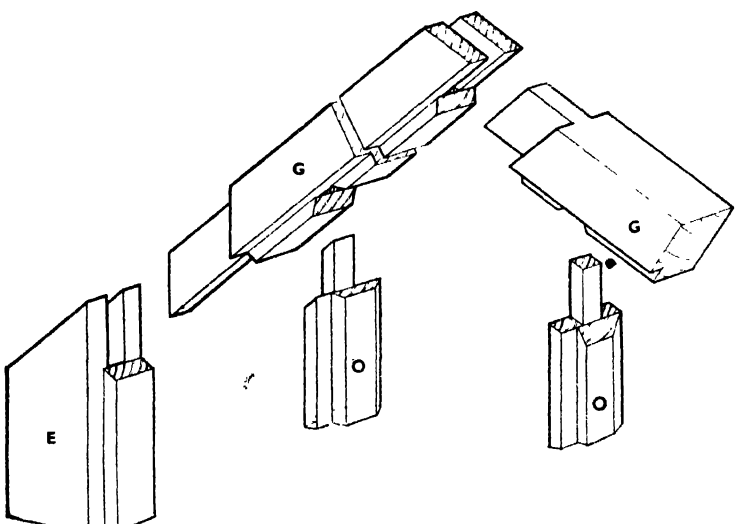


FIG. 12.—JOINTS USED IN SLOPING MEMBERS OF END.

with two cramps, make sure that they are level, and bore bolt holes as in Fig. 14. Carriage bolts should be used, and the nuts should be tightened over washers. Having fixed the whole, the tops of the uprights can be sawn to agree with the slope of the roofs. All raw, exposed wood should be given a coat of priming. In fact, the frames should not be assembled until the roof frames are ready, but we

deal with the assembling now for convenience. The lower portion is filled in with match-boarding or with weather boards, this being nailed to fillets fixed round as in Fig. 9.

Fig. 7 shows the roof frame, and Fig. 13 gives the joints required. Note that, although the top rail (*J*)

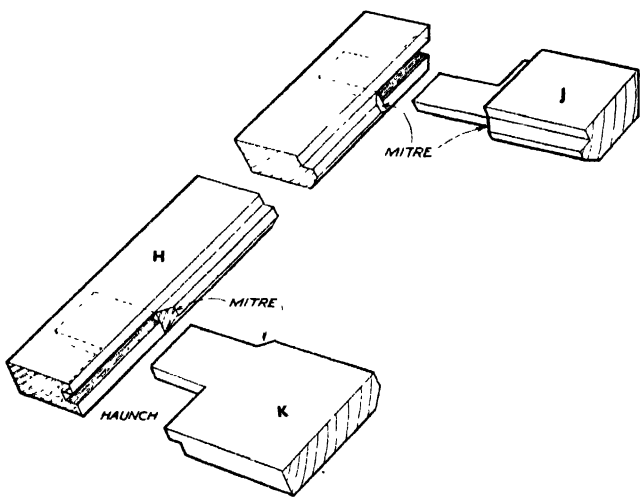


FIG. 13.—ROOF JOINTS. NOTE THAT GLASS RESTS ON BOTTOM RAIL (K).

is of the same thickness as the sides (*H*), the bottom rail (*K*) is thinner, so that the glass rests upon it and water is thus free to drain off. Work rebates in the required positions. Two stout rails (*M*) are required to stiffen the centre and to give a fixing for the ventilator frame. Either both or only one roof can have a ventilator.

In the best work tapering grooves are cut across the rail between each bar. These allow any condensate from the roof to drain away to the outside.

Cutting List

	Length.	Width.	Thickness.
Side Frames.			
(*A*) 4 Uprights .	5 ft 8 in.	—	2 in. sq.
(*B*) 2 Rails . .	9 „ 10 „	3¼ in.	2 „
(*C*, *D*) 4 „ . .	9 „ 10 „	—	2 „
4 Uprights .	2 „ 6 „	—	2 „
4 „ .	3 „ 6 „	—	2 „
(*O*) 8 Bars . .	3 „ 3 „	—	—
(*O*) 4 „ . .	3 „ 0 „	—	—
36 Matchings .	2 „ 1 „	6 „	¾ „
(or use horizontal weather boarding)			
4 Window rails .	3 „ 1 „	—	2 „
4 „ stiles	3 „ 1 „	—	2 „
End Frames.			
(*E*) 4 Uprights .	5 „ 8 „	3 „	2 „
(*F*) 2 „ .	7 „ 1 „	—	2 „
1 „ .	2 „ 5 „	—	2 „
(*G*) 1 Rail .	6 „ 9 „	—	2 „
(*G*) 2 Rails . .	2 „ 9 „	—	2 „
(*D*) 2 „ . .	6 „ 9 „	—	2 „
(*G*) 1 „ . .	4 „ 3 „	—	2 „
(*G*) 1 Rail . .	2 „ 3 „	—	2 „
(*O*) 1 Bar . .	5 „ 0 „	—	—
(*O*) 2 Bars . .	4 „ 9 „	—	—
(*O*) 4 „ . .	4 „ 0 „	—	—
20 Matchings .	2 „ 1 „	6 „	¾ „
2 Stiles . .	6 „ 5 „	3 „	1 „
2 Rails . .	1 „ 11 „	3½ „	1 „
1 „ . .	1 „ 11 „	6 „	1 „
1 Bar .	5 „ 6 „	—	—
4 Bars . .	1 „ 9 „	—	—
Roof.			
(*J*) 2 Rails . .	10 „ 4 „	5¼ „	1 „
(*K*) 2 „ . .	10 „ 4 „	7¼ „	1 „
(*H*) 4 Stiles . .	4 „ 11 „	5¼ „	1 „
(*M*) 4 „ . .	4 „ 4 „	2 „	1 „
2 Rails . .	3 „ 7 „	2 „	1 „
(*N*) 8 Bars . .	4 „ 3 „	—	—
(*N*) 4 „ . .	2 „ 3 „	—	—
4 Frame rails .	3 „ 1 „	3½ „	¾ „
4 „ .	1 „ 10 „	3½ „	¾ „
4 Stiles . .	2 „ 1 „	2 „	1 „
2 Rails . .	3 „ 4 „	2 „	1 „
2 „ . .	3 „ 4 „	3¼ „	¾ „
(*N*) 4 Bars . .	1 „ 11 „	—	—
1 Ridge . .	10 „ 6 „	5 „	⅞ „
1 Capping .	10 „ 6 „	5 „	⅞ „

Allowance has been made in lengths and widths. Thicknesses are net. Small parts are extra.

It is not essential, however, and in their absence the water will merely run or drip down the side frames, where in the long run it will cause discoloration. The ventilator is made similarly to the main frame so that water is free to drain away at the lower edge without being trapped by a rebate.

At the top a ridge piece is fitted and the roofs are bevelled to fit close up to this. At the ends the ridge piece is notched to fit over the end frames. To fix the roofs bolt through to the end frames and nail into the ridge piece. Finally, fit a capping over the latter. Drip grooves are worked at the edges to prevent water from seeping inwards. The door can be as in Fig. 9 or it can be of any standard pattern.

Before glazing it is essential that all surfaces, including the rebates, are given a coat of priming. The glass is then bedded in putty, an overlap being arranged as shown if necessary. When giving the undercoat and gloss coats carry the paint slightly over on to the glass so that the whole is sealed.

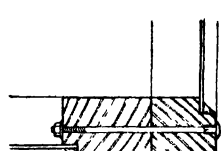


FIG. 14.—HOW FRAMES ARE BOLTED TOGETHER.

§ 3. GARDEN SCREENS AND TRELLIS

For a dividing screen Fig. 16 is useful on account of its easy adaptibility in length and height. The screen arrangement on either side, with alternative

square and diamond barring, is suitable either for climbing plants or for being left plain. The thickness

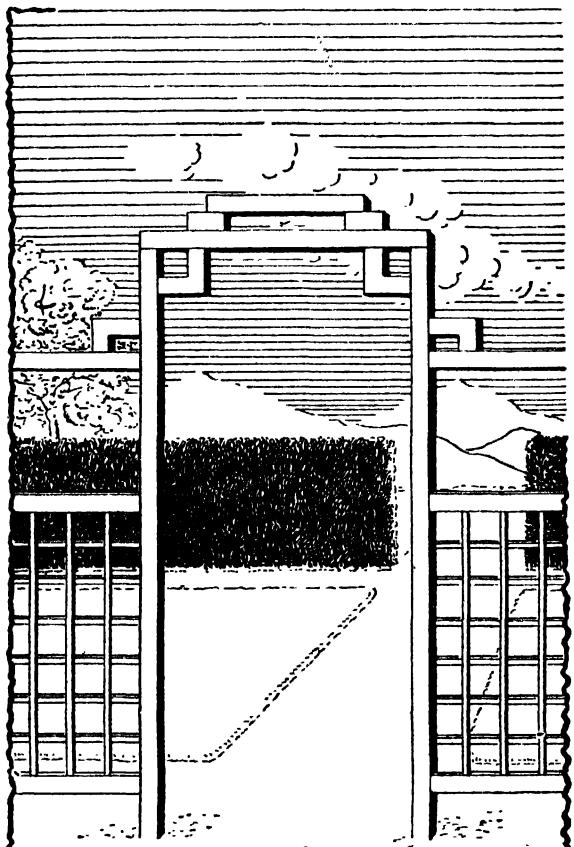


FIG. 15.—GARDEN ARCH AND SCREEN.
A decorative feature for the garden.

of material used depends on the length and weight of screen: partly, too, on whether a wall is available at either side for fixing. For one of the size of Fig.

16 the posts (*A*) should be not less than 3 in. by 3 in., or 3 in. by 2 in. with the 2-in. width showing on face. In the case of smaller screens the posts should never be less than 2 in. by 3 in. For the intermediate posts (*B*) and the cross-rails (*C*) slightly lighter material may be used, but it is often more convenient to have all the framing of the same

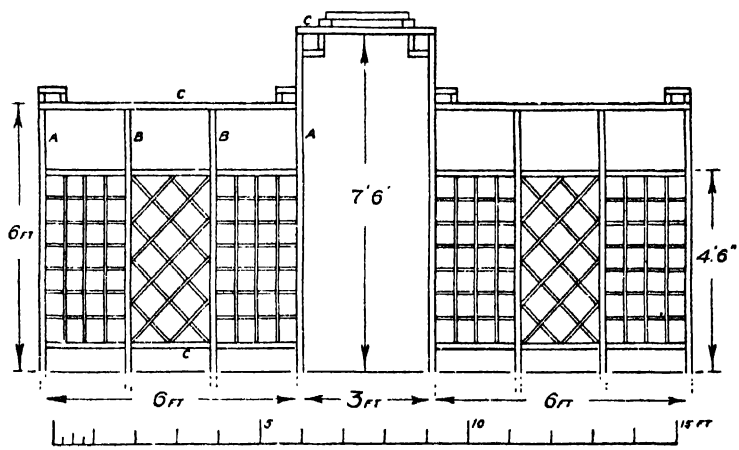


FIG. 16.—GARDEN SCREEN WITH ARCHED GATEWAY.

strength. The joints are usually made by halving or notching (Fig. 19), the meeting parts being thoroughly smeared with thick paint, and the joints then held by hardwood pegs painted and driven through.

For bold trellis barring as in Fig. 16 the laths may be $1\frac{1}{4}$ in. by $\frac{1}{2}$ in., fixed to fillet scantling nailed to the posts. This applies to fairly wide openings of about 6 in., but if the spacing is closer, a smaller lath will be used. Ordinary trellis laths vary from $\frac{3}{4}$ in. by $\frac{1}{4}$ in. to 1 in. by $\frac{1}{2}$ in., and in every case the purpose

for which it is required and its relation to the general design have to be taken into consideration. The laths can be fixed by means of fillets nailed to posts and cross rails, as in Fig. 20.

Fig. 17 is a type of screen which might partition off a vegetable plot from the flower-garden. For a short screen the minimum thickness for post is 2 in. by 2 in., and when the length exceeds 10 ft. it is wise

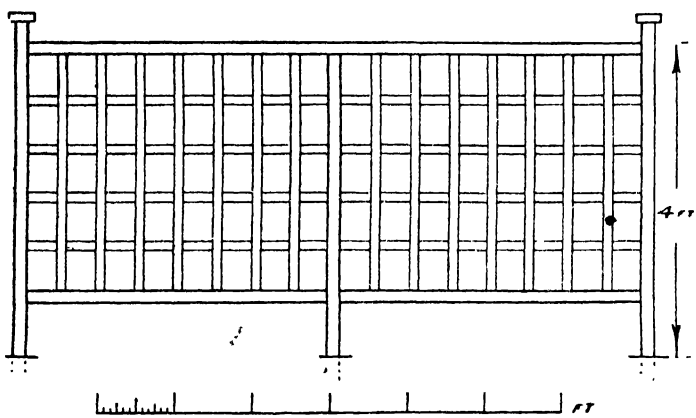


FIG. 17.—SIMPLE DIVIDING SCREEN FOR GARDEN.

to have 3 in. by 3 in. for rigidity. The type of barring shown here is similar to that at Fig. 16, stout laths being used.

Fig. 18, again, is the ordinary type of garden trellised paling, a convenient height for which is about 5 ft. The posts here may be increased to 4 in. square, especially for lengths of paling running to 25 ft. or more. The lower part may be boarded up with cleft slats, overlapping; or, more formally, with 4-in. tongued and grooved match-boarding. Light

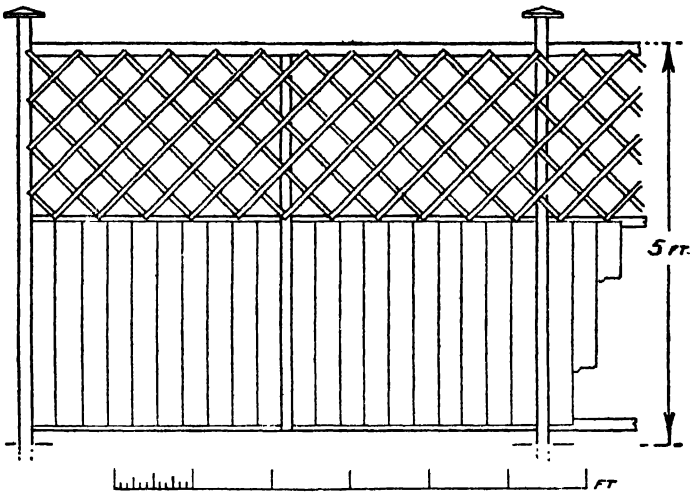


FIG 18.—GARDEN TRELLISED PALING.

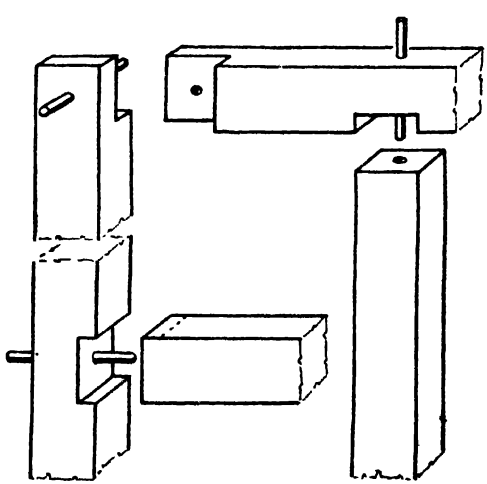


FIG. 19.—HALVING AND NOTCHING FOR SCREEN FRAMING.

laths not exceeding $\frac{7}{8}$ in. by $\frac{3}{8}$ in. will serve for the upper trellis.

When arches are erected without accompanying screens, allow a head clearance of not less than 7 ft. for a width of from 3 ft. to 3 ft. 6 in. An isolated arch seems dwarfed if kept lower, and is apt to be an

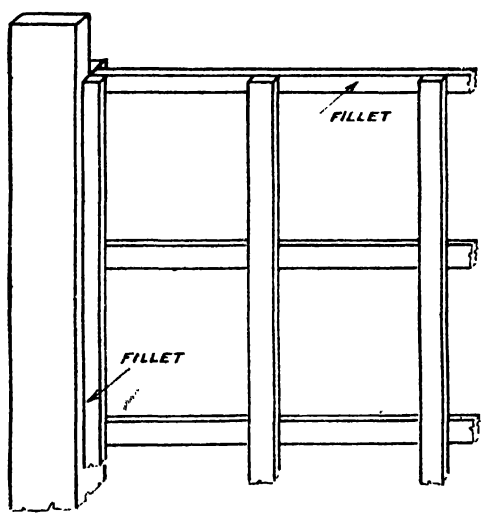


FIG 20.—METHOD OF FIXING BARRING.

inconvenience when drooping creepers hang from it. For an arch which is a mere gateway, the clearance need not exceed 6 ft. 6 in., although (as in Fig. 16) it is usual to raise it when there is a fairly high screen.

All posts should be cut so that they may enter the ground from 12 in. to 18 in. as necessary, the lower portions being well tarred. The thorough painting of joints (leaving no part of the wood bare) is the

best protection against deterioration. After the preliminary priming of red lead, all the woodwork should have two coats of paint, with a fresh coat every two years.

§ 4. GARDEN SEAT

3 ft. 9 in. long. Or may be 4 ft.

When making a garden seat the seat should be well below the height of an ordinary dining-room chair, so that the legs of the sitter are comfortably rested. In determining the height, allow also for the likelihood of a cushion being used. It is also

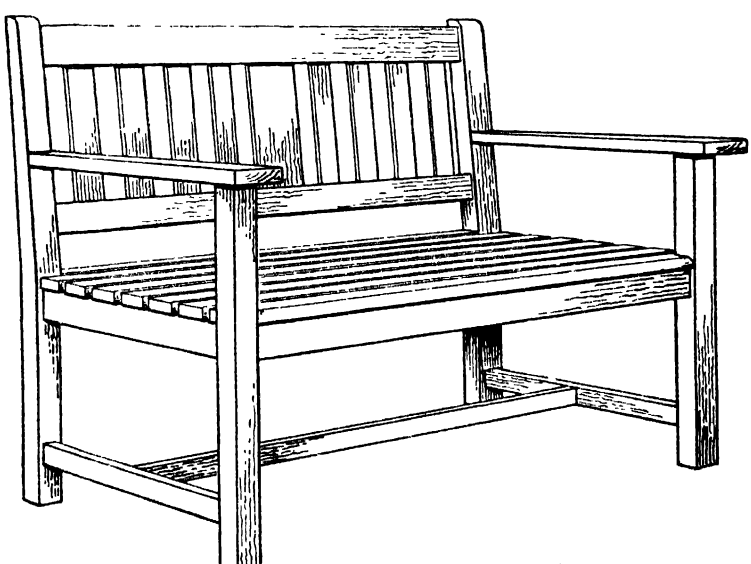


FIG. 21.—COMFORTABLE GARDEN SEAT, 3 FT. 9 IN. LONG. Could be in hardwood finished with varnish, or enamel could be used to finish it.

advisable to have an ample distance from front of seat to back. With a wide and fairly low seat it is not necessary to give much of a rake to the back legs.

In Fig. 22 the seat rails (*D*) are shown as perfectly horizontal—the most simple in construction. If preferred they may be arranged to slope gently

CUTTING LIST

	Length.	Width.	Thickness.
(*A*) 2 Front legs	2 ft. 2 in.	2 in.	2 in.
(*B*) 2 Back ,,	3 ,, ½ ,,	3 ,,	2 ,,
(*C*) 2 Seat rails	3 ,, 9 ,,	2½ ,,	1¼ ,,
(*D*) 3 ,, ,,	1 ,, 8 ,,	2½ ,,	1¼ ,,
(*E*) 2 Underframe rails	1 ,, 8 ,,	1½ ,,	1¼ ,,
(*F*) Stretcher rail	3 ,, 8 ,,	1½ ,,	1¼ ,,
(*G*) Back rail	3 ,, 9 ,,	3 ,,	1¼ ,,
(*H*) Lower back rail	3 ,, 9 ,,	2½ ,,	1¼ ,,
(*J*) 2 Arms	1 ,, 9 ,,	4 ,,	1 ,,
(*K*) 7 Seat laths	3 ,, 9 ,,	2 ,,	7/8 ,,
1 Front lath	3 ,, 9 ,,	2½ ,,	7/8 ,,
(*L*) 8 Back splats	11 in.	2 ,,	5/8 ,,
1 Middle splat	11 ,,	5 ,,	5/8 ,,

Lengths and widths allow for joints. Thicknesses given are intended to be net.

towards the back—say, a matter of ½ in. Alternatively, the top edges of the three seat rails (*D*) may be slightly curved (concave), so that, when the laths are fitted, the seat has a dip of about ½ in. in the centre.

For a seat up to 4 ft. long follow the widths and thicknesses given in the cutting list. For a length of 4 ft. 5 in. or 5 ft. increase the stuff for legs to 2½ in. square, and use 3 in. by 1½ in. for the seat rails and 2 in. by 1½ in. for the underframing rails. This applies to hardwood. Note that in the construction

glue is not used. All the joints are fitted with thick paint and secured with hardwood dowel pegs also painted in.

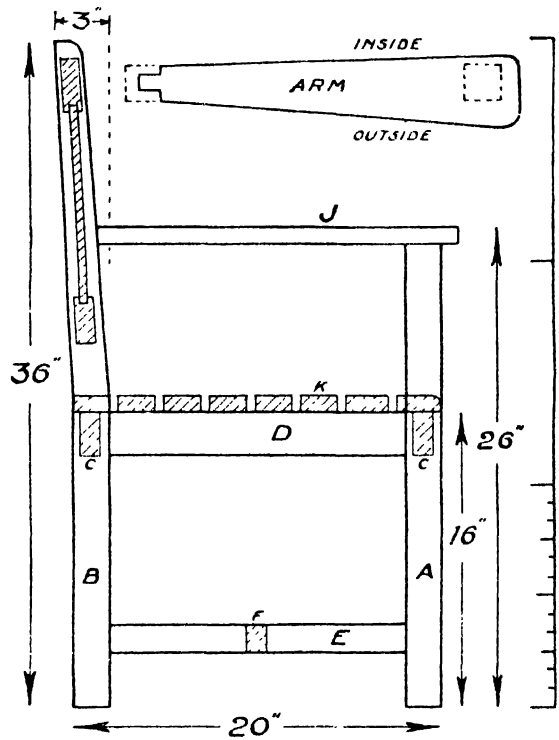


FIG. 22.—SECTIONAL END VIEW SHOWING RAKE OF BACK.

First complete the two ends. The back legs (*B*) can be got out of boards 3 in. wide to allow for the rake. At the top they may be tapered slightly (not more than ¼ in.) as indicated at Fig. 22. The rails (*D*) and (*E*) are tenoned to the legs. The arm (*J*) enters the back leg by a tenon. To the front leg it should

be wedge-pegged through the stub tenon shown in Fig. 23. Note the plan of arm in Fig. 22.

The upper back (Fig. 23) is next tackled. The rails (*G*) and (*H*) are grooved $\frac{5}{8}$ in. wide and about $\frac{3}{8}$ in. deep throughout their length to take the splats (*L*),

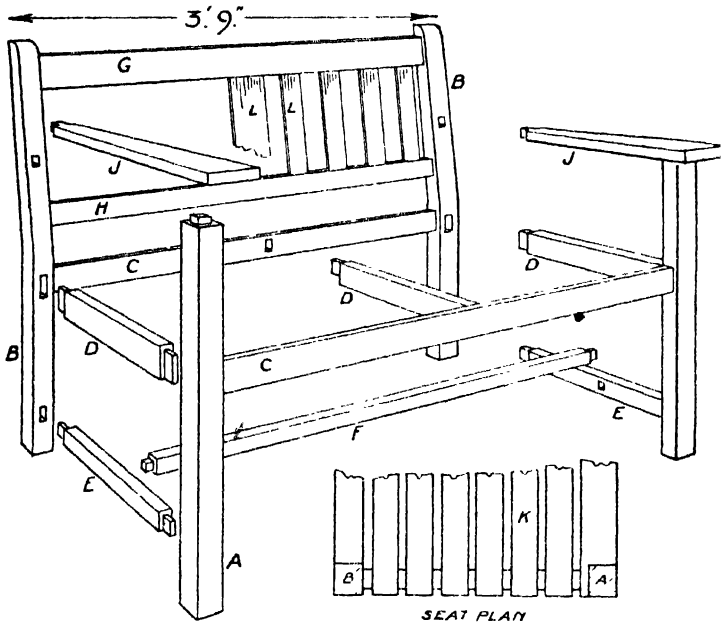


FIG. 23.—HOW THE SEAT IS ASSEMBLED.

which, correctly spaced, are painted in. Short lengths of hardwood ($\frac{3}{8}$ in. by $\frac{5}{8}$ in.) are cut to fit the spaces left in the grooves between the splats, and also painted in. The seat may now be assembled, the two completed ends being connected by the seat rails (*C*, *C*), the back (*G*, *H*) and the stretcher rail (*F*) all tenoned in and well cramped. Do not overlook

the intermediate cross rail (*D*), which is required as a central support for the seat laths (*K*). In screwing down these laths use brass screws, carefully countersinking for the heads and driving them well home. Also note that the laths overhang the rails at the ends, being kept flush in line with the legs.

§ 5. TIMBER-FRAMED ASBESTOS-CEMENT GARAGE

Car owners can save quite a lot of the expense of a garage by building their own. That shown in Fig. 24 measures about 16 ft. by 9 ft. with an effective clearance width between the doors of 7 ft. 2 in. If necessary these sizes could be adapted within a little to suit special requirements. It has flat asbestos-cement panels at the sides, and corrugated asbestos-cement roof. The framing is of timber, and before a start is made the requirements of the local authorities should be ascertained, because some object to timber.

It will be seen from Fig. 25 that the front and rear frames are contained between the sides to which they are bolted. Trusses are built at the top, and it should be noted that special angle braces are fitted at the top corners of the front. These are fixed behind the frames, and their purpose is to stop side racking. They are unnecessary at the back, because there is a sufficient rigidity. Of the sides (Fig. 26) one has a window and door; the other can have window only or be blank. A centre truss is added as in Fig. 27, and purlins are fixed along the whole to which the corrugated asbestos can be bolted.

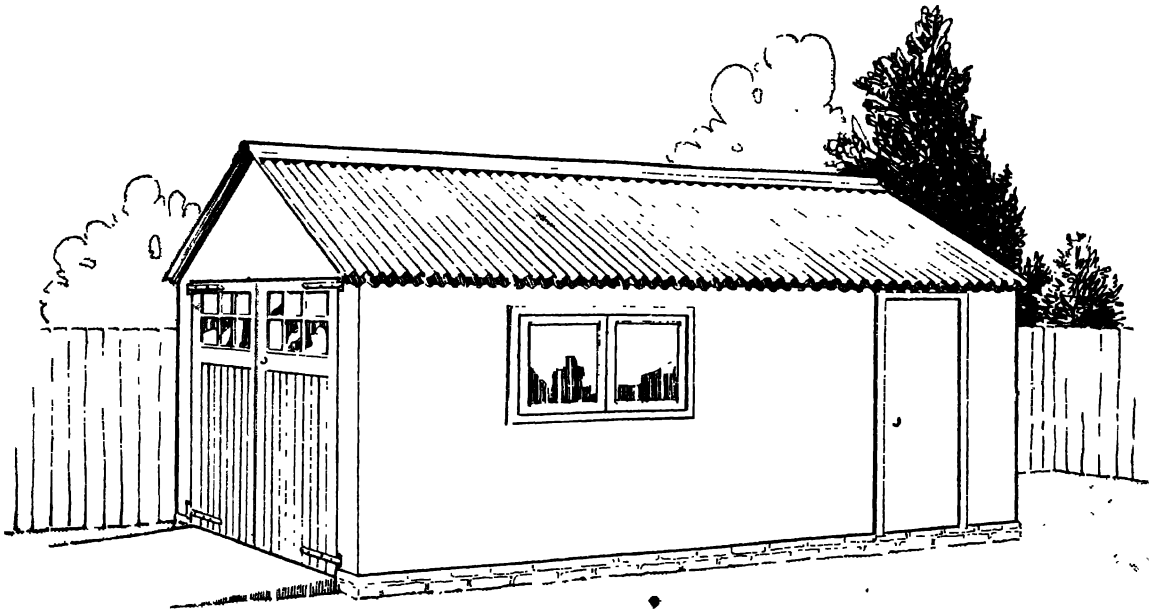


FIG. 24.—TIMBER-FRAMED GARAGE WITH ASBESTOS-CEMENT WALLS AND ROOF

The whole thing should rest upon a brick footing laid on concrete foundation. A suitable mix for the latter is 5 parts shingle, 3 parts sand, and 1 part Portland cement. This is laid in a channel dug round beneath the walls, and three courses of bricks are put on top at sides and back and at the immediate returns at the front. Between these footings the earth is excavated and a layer of hard core put down.

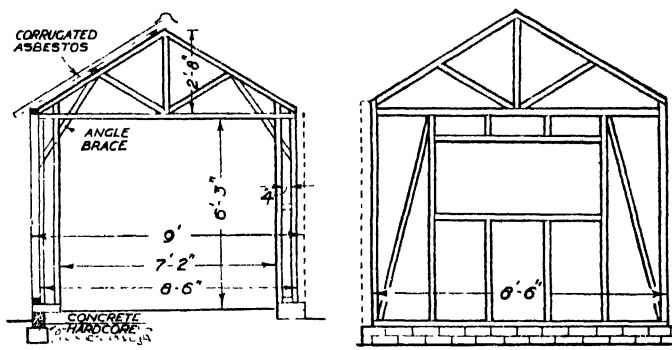


FIG. 25.—ELEVATIONS OF ENDS.

On this is a 4-in. concrete surface, and it is a good plan to give a slight slope towards the front so that water, whether from a wet car, or when draining the radiator, passes out beneath the doors easily.

The frames are put together with simple halved or notched joints. One good plan is to halve the main corners and notch the others. Remember to allow for the side door and window, and add diagonal braces wherever practicable. The simplest plan is to assemble each frame on flat ground. Test for squareness, and insert the braces, skew nailing where

necessary. In the case of the front frame make sure that the lower end is exactly the same width as the top. A good plan is to nail a batten across temporarily. It is as well to bolt the angle braces, as they take considerable strain. The fact that they

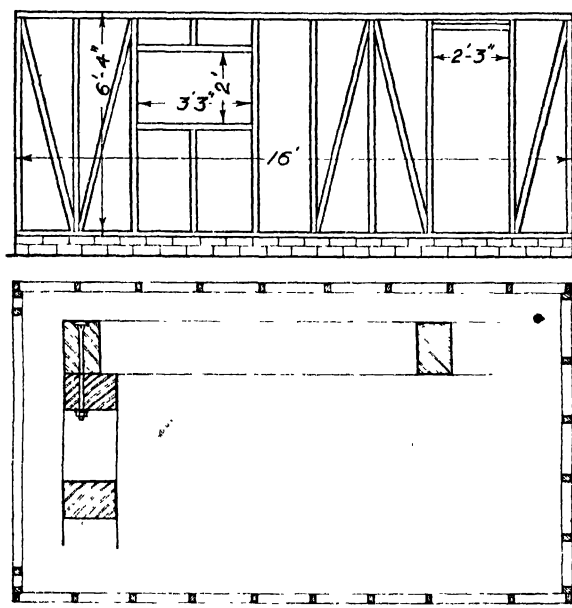


FIG. 26.—SIDE ELEVATION AND PLAN.

pass across the corners does not matter, because there is ample clearance for the car.

To erect the whole put two adjacent frames together, holding with a cramp, and bore to take three $\frac{5}{16}$-in. bolts at each corner. Work round the whole in the same way. It will be seen from Fig. 25 that the frames are level with the *outside* of the brick

footing or project slightly, so that the asbestos-cement panels can pass down slightly and thus prevent water from getting in. In any case it is as well to put a strip of damp-course felt beneath the framework as a safeguard against damp creeping up.

The centre roof truss is made up as a separate unit, and, as it is desirable for it to rest upon the side

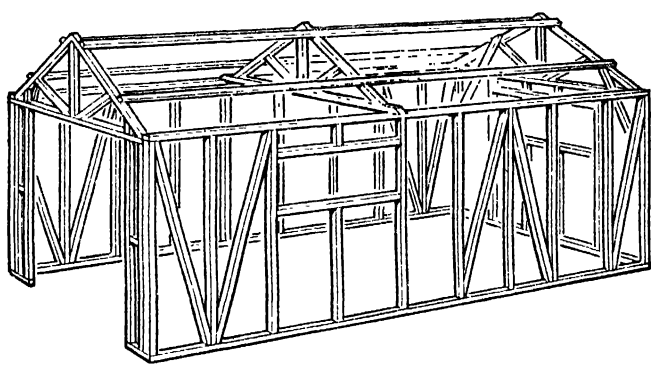


FIG. 27.—GENERAL CONSTRUCTION.

frames, the rafters must be set in slightly so that they are in alignment with front and back. The exact position is easily found by placing the bottom tie beam immediately behind front or back, and cutting and fitting the rafters so that they line up with those of front and back. Nail in position and add the two purlins at each side. Note that they allow the roofing asbestos-cement to rest also upon the rop rails of the side frames (see Fig. 25).

The covering now follows. The roofing is held with galvanised screws, the heads of which bear on

to specially curved washers. The holes to take them must be drilled through the hills of the corrugations, not the valleys, and the heads of the bolts should be smeared with mastic to keep out water. A galvanised ridge strip is added lastly as in Fig. 25.

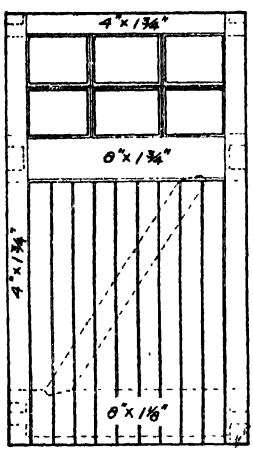


FIG. 28.—DETAILS OF DOORS.

Side covering should be fixed with galvanised round-head screws tightened over washers. Where joining is necessary, a strip of wood can be placed over the joint. Incidentally, it is a good plan to ascertain the standard sizes of panel available, and arrange the uprights of the frames accordingly so that joints can occur in the middle of the uprights. In any case it is as well to add wood corner strips as a protection as the asbestos-cement is somewhat brittle.

Doors are made as in Fig. 28. The rails are through-tenoned and wedged, and a brace added to each as shown by the dotted lines. Note that top and middle rails are $1\frac{3}{4}$ in. thick, but that at the bottom is only $1\frac{1}{8}$ in. This allows $\frac{5}{8}$-in. matching to pass right down to the bottom. Standard section bars are used for the glazed top portion, the glass being bedded in putty and a putty seam put round inside. It is usual to use frosted glass. Special stout garage door hinges are used.

Casement windows can be used at the side and

back. Standard sash material is used and the usual through-tenons cut, these being wedged at the outside. To keep out damp a fillet is nailed round the frame immediately behind the window, this forming a rebate. For the small side door either a panelled or a ledged-and-braced type can be made. Here again a fillet at the inside helps to keep out moisture.

All woodwork can have the usual three-coat finish, but it is advisable to give the asbestos-cement panels a special sealing coat before painting.

§ 6. DOUBLE COAL BUNKER

Exact sizes of the bunker can be varied to suit the space available and the accommodation needed. As shown, it will hold in the region of a ton of fuel, though if the latter is light and bulky it will not hold so much. Except for the concrete base, the whole thing is of timber, consisting of separate frames of 2-in. by 2-in. deal, put together with simple notched joints nailed together and covered with boards either tongued together or of weathered section. It is intended that the sides be painted and the roof covered with roofing felt. The lids are loose and have simply to be lifted off when the bunker is being filled. Access to the hatches is by means of sliding doors, which are raised.

The concrete base should be about 4 in. thick, and should be laid on a flat surface which has been consolidated by tamping. Loose earth is liable to

sink so that the concrete has unequal support and is thus liable to crack. The mix should be 1 cement, 3 sand, 3 broken stone, and just over ½ water. Mix the materials dry, turning them over three times, then add the water, using a water can. An edging of

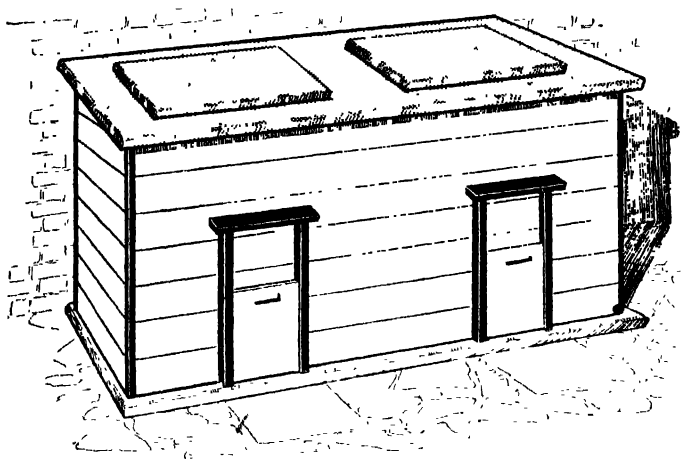


FIG. 29.—DOUBLE COAL BUNKER IN WOOD ON CONCRETE BASE.

boards held in place with pegs driven into the ground should be prepared to contain the concrete. The top edges should be made true to enable the surface to be levelled by drawing a straight-edge back and forth across them.

Back and front frames are rectangular and are made to the sizes in Fig. 30. It will be realised that the top edges of both have to be bevelled to allow for the sloping roof, but this is best done after the parts are together. So far as the top and bottom

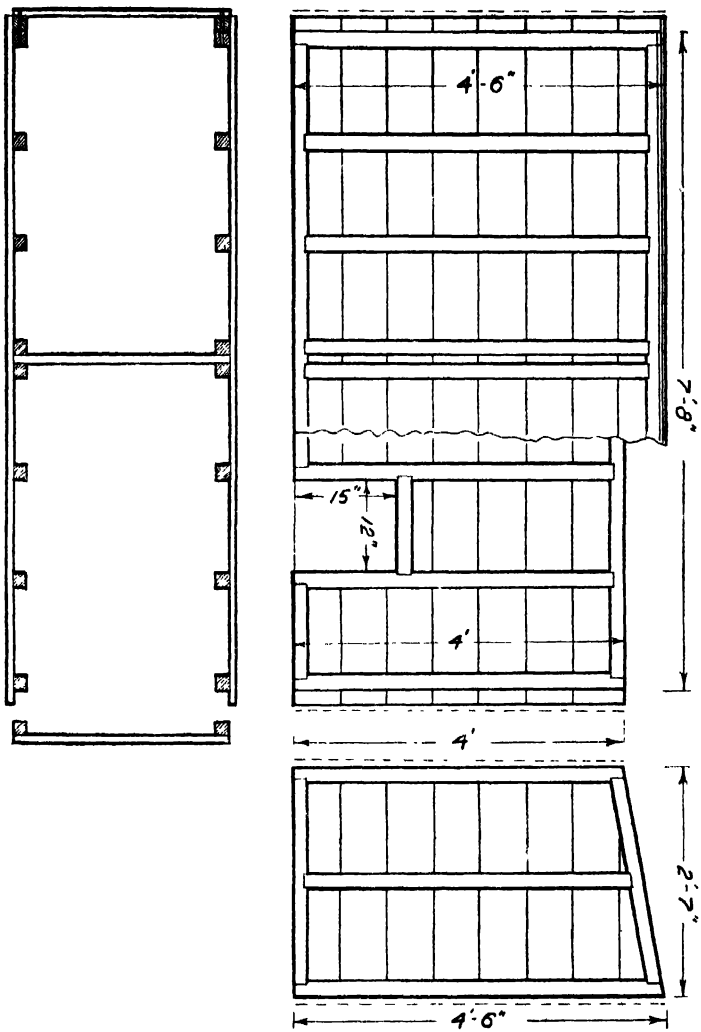


FIG. 30.—SIZES AND CONSTRUCTION OF THE FOUR FRAMES, AND PLAN VIEW SHOWING HOW PARTS ARE BOLTED TOGETHER.

rails are concerned, all are identical except the bottom front, which is in three pieces to allow for the hatches. Set out one and mark the others from it. Notches $\frac{1}{4}$ in. deep are cut, the idea being that these resist all movement, the nails merely serving to keep the parts in position. The uprights are in two sizes for the back; those at the ends, and those between

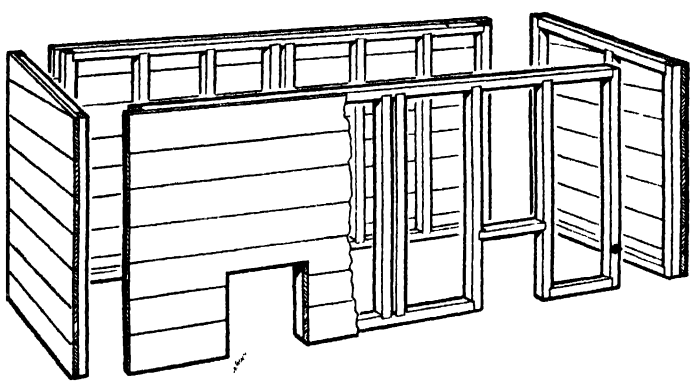


FIG. 31.—EXPLODED VIEW SHOWING FRAMES AND HOW THEY ARE BOARDED.

the rails. If the former are cut out and marked first the length of the others can be taken from the notch shoulders with $\frac{1}{2}$ in. added to allow the projection into the notches. For the front three lengths of uprights are needed; those at the ends, those at each side of the hatch, and the middle ones where the partition is fixed. Here again the easiest plan is to mark the end ones and mark the others from them. Note that notches are needed in the hatch uprights.

Fix all the parts together with French nails and

test for squareness. A batten nailed diagonally across will hold the whole true temporarily until the boarding is added.

The ends are slightly more complicated in that the sloping top rail has to be allowed for. The simplest way is to fix the bottom rail to the uprights, leaving the latter an inch or so long, and nail a temporary batten across all three, making sure that all are the

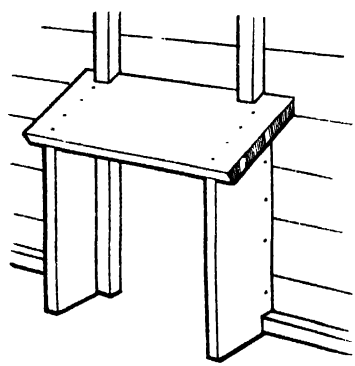


FIG. 32.--INSIDE GUARD WHICH KEEPS COAL FROM OPENING.

same distance apart when measured across horizontally. The top rail can then be placed in position and pencil lines drawn in to show the amount to be sawn off; also the angle. Again nail and test for squareness, nailing a diagonal across when true.

When fixing the boarding at the ends the edges are finished flush. At front and back, however, it projects so that it covers over the framework of the ends. Use two nails through the boarding into each framework member, and " dovetail " the nails so that they have maximum grip. The partition can simply be

a series of rough boards contained between the centre uprights. It is best added after the main frames have been assembled. To hold the sides together use three $\frac{5}{16}$-in. or $\frac{3}{8}$-in. carriage bolts at each corner, placing washers beneath the nuts so that they do not bite into the wood. The gaps at the corners are filled in with $\frac{7}{8}$-in. fillets nailed in.

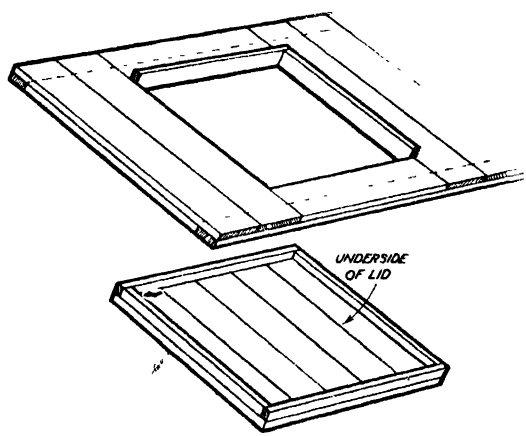


FIG. 33.—DETAILS OF TOP AND LIDS COVERING FILLING APERTURES.

Fig. 32 shows how a guard is fixed inside each hatch so that fuel is kept back as far as possible. The parts are nailed together and to the framework. The roof consists of a series of boards running from front to back, with a strip along the length at top and bottom at the underside as in Fig. 33. Filling-in pieces are added at the ends. To raise the lids a lining to project about 1 in. is nailed around the openings. The lids themselves have an edging at the underside to make a generous fit over the lining.

After painting, the whole roof and lids are covered with roofing felt.

Hatch doors are made to slide in grooves worked in uprights fixed at each side of the opening. The tops of these uprights are cut at an angle so that a top can be added to throw off water. A simple hardwood turnbuckle holds the door in the raised position when required.

§ 7. GARDEN FRAME

A frame can be of practically any size. That shown in Fig. 34 is about 4 ft. by 3 ft. It consists in the main of a front, back, and two sides, the last

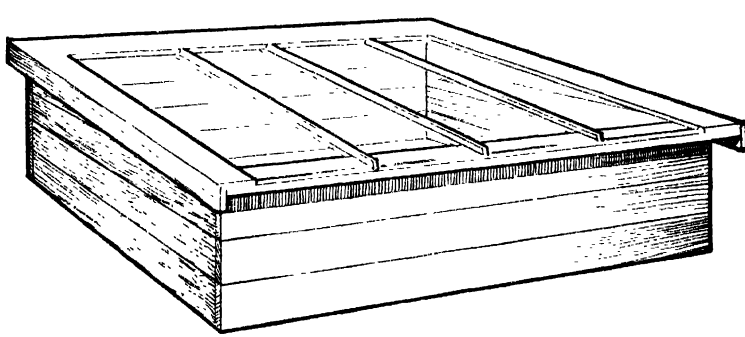


FIG. 34.—SIMPLE GARDEN FRAME.

named being lower at the front to enable water to drain away easily at the top. Matchboarding $\frac{7}{8}$ in. thick is suitable to use, and it is held together with cross battens nailed on at the ends. One point to note is that the top piece of matching is necessarily tapered, and it is advisable to avoid making this run to a point at the front because it would be awkward to nail. Leave it at least 2 in. wide. It will be seen

from Fig. 35 that the cross battens stand in from the end in every case. This makes a much stronger joint when the whole thing is assembled.

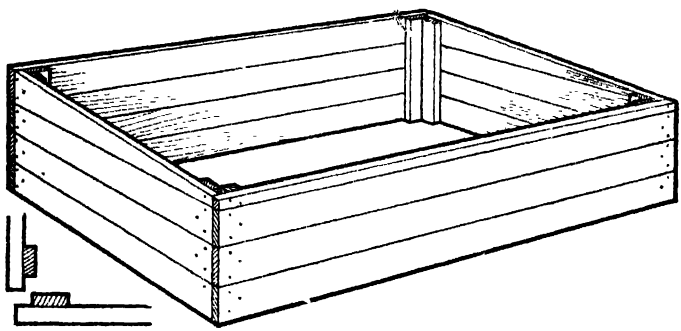


FIG. 35.—HOW THE MAIN FRAMEWORK IS MADE.

To make a really good job of the top frame it should be put together with mortise and tenon joints

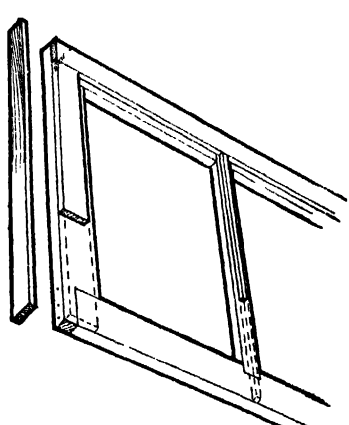


FIG. 36.—CONSTRUCTION OF THE TOP LIGHT.

wedged from outside and held with paint. A simple alternative is given in Fig. 36. The main frame is of

1¼ in. stuff, and notches are cut at the ends of the sides to enable it to be nailed up strongly. In a similar way the intermediate cross rails are fixed in notches. To form a rebate for the glass ½ in. strips are fixed to the top at back and sides. These are ½ in. narrower than the main frame. They are nailed down, a coat of paint being brushed on first. (Glue, of course, is useless.) There is no strip at the front because the glass reaches right over the front rail, thus allowing water to drain off freely. Either single sheets of glass can be used, or two or more panes to each space. In the latter case the bottom glass is laid in position first, the second overlapping it by about 2 in. In any case a good bed of putty should be laid in the rebate first and the glass pressed down. Remember to paint the rebate first or the putty will not adhere. Side trips can be added as in Fig. 36, and also one at the back. The latter prevents water from trickling through into the inside of the frame.

The whole thing should be well painted or creosoted to keep out the damp.

§ 8. GARDEN WORKSHED

Those who can spare the space for the purpose will find a garden workshop a tremendous asset. It saves the inevitable dust and dirt from treading into the house, and, being isolated, the noise will not disturb others. That shown in Fig. 37 is of the simple lean-to type which can stand in practically any position, and it is portable in that it is made in six separate sections bolted together. This facilitates its easy removal to another site if desired.

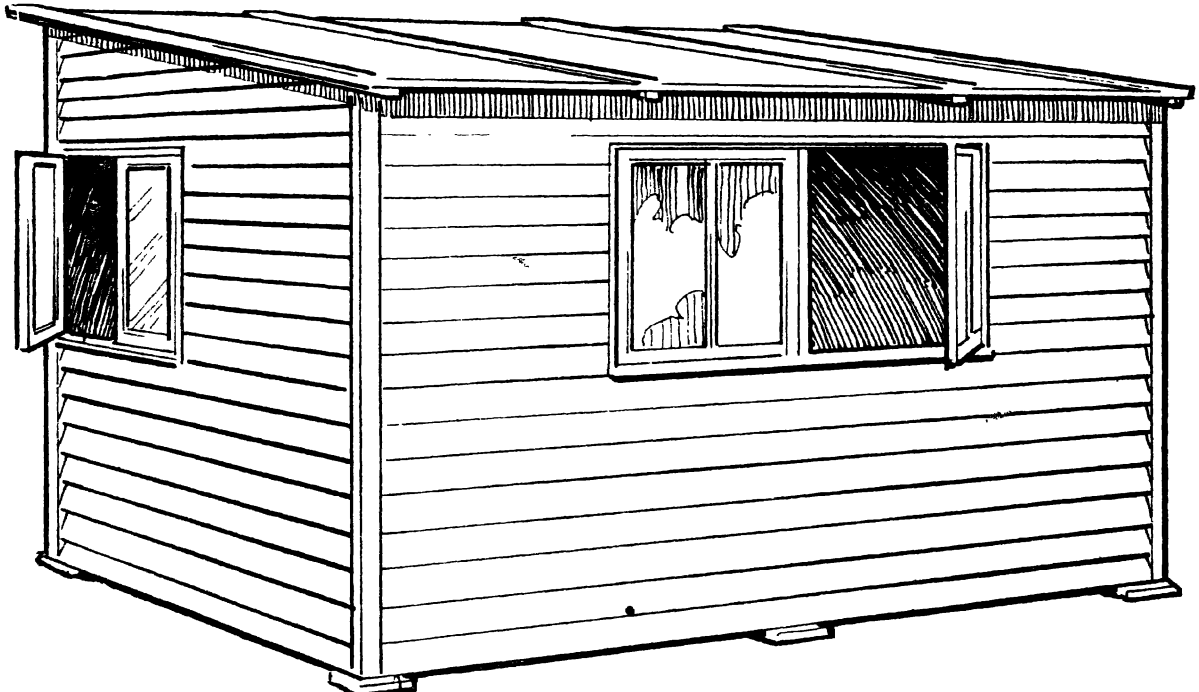


FIG. 37.—USEFUL GARDEN WORKSHED, MADE TO TAKE TO PIECES.

The side and end windows give ample light, and the door at one end enables timber, etc., to be carried in or out easily. As given in Fig. 38 it measures 10 ft. by 6 ft. in plan. This is really the smallest

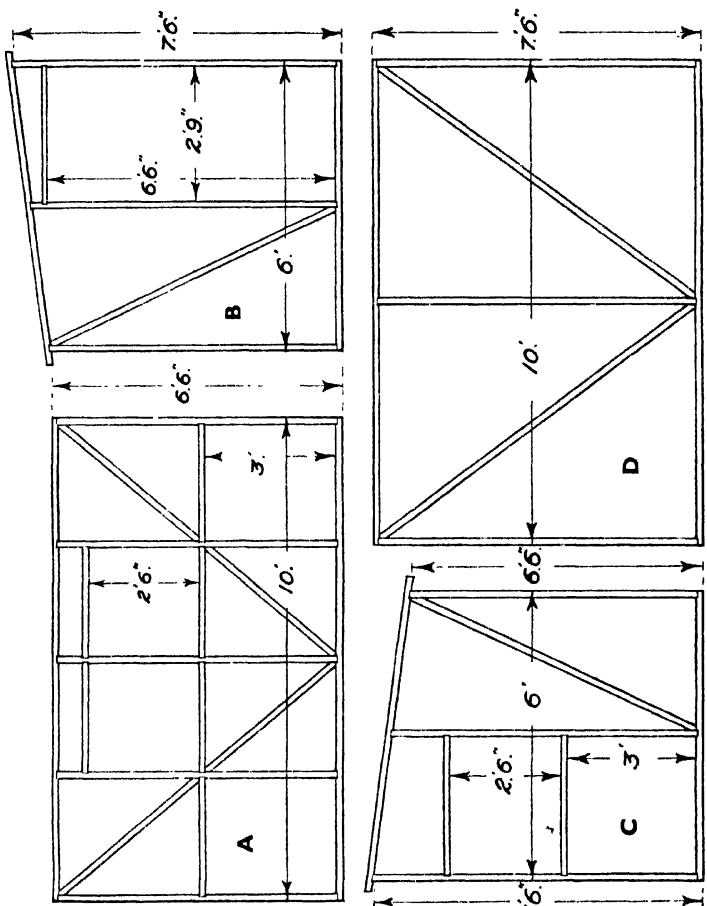


FIG. 38.—ELEVATIONS WITH SIZES OF THE MAIN FRAMES.

practicable size for a workshop, and a foot or so could easily be added without seriously altering the construction.

Weather boarding is suggested for the covering in Fig. 41. This looks attractive in a garden, though tongued and grooved boards could be substituted if desired, in which case the boards should be upright rather than horizontal. One point to note in this connection is that a saving in labour can often be effected by fixing the dimensions in accordance with the material being used. For instance, if the weather-boarding is 6 in. wide exclusive of the overlap, it is an advantage to make the height of back and front multiples of 6, so that unnecessary work in ripping down timber is avoided. The same thing applies to the door, the width of which is controlled by the width of matching being used. The floor boarding too can be made to fit the width. Another point worth bearing in mind is that the window sashes can, if preferred, be obtained ready made. They usually run in standard sizes, and it is as well to ascertain what these are before beginning the work so that the positions of the members of the framework can be decided to suit.

Begin work on the front and back frames, making these out of 2-in. by 2-in. stuff. The joints are of the simplest notched variety put together with nails driven in askew. Assemble the parts on a flat patch of ground and test for squareness. Temporary laths can be nailed across the whole to steady them. The addition of the diagonal struts makes them perfectly stiff. The end frames follow, and it will be

seen that they are higher than the front and rear by the thickness of the rafters (2 in.).

The floor is made to the over-all size of the shed when assembled, since the frames stand upon it.

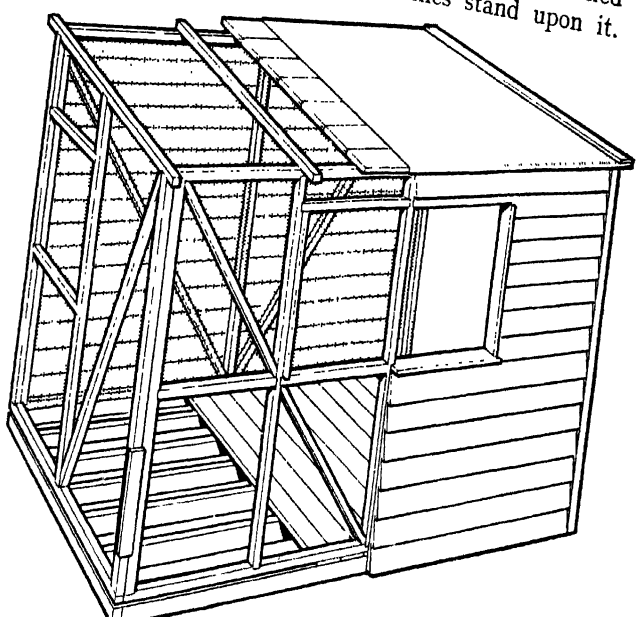


FIG. 39.—CUT-AWAY VIEW SHOWING GENERAL CONSTRUCTION.

A framework is made of 4-in. by 2-in. joists. There are the four pieces forming the sides and a series of intermediate ones running lengthwise. They are joined with either mortise and tenon or notched joints, and the whole is nailed together. This framework (forming the joists) can be seen in Fig. 39. The

whole thing rests upon brick foundations built upon concrete. There is one at each corner and one in the middle of each long side. The frame rests upon these, any levelling being done by packing in pieces of slate. The flooring is of $\frac{7}{8}$ in. stuff nailed down.

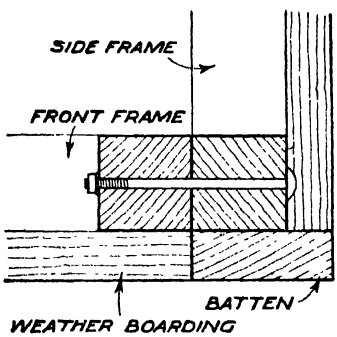


FIG. 40.—PLAN SECTION THROUGH CORNER

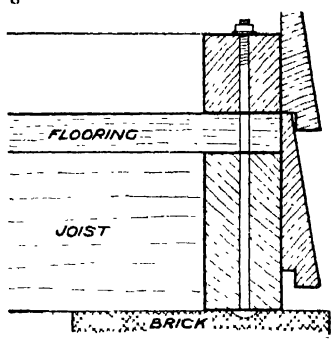


FIG. 41.—SECTION THROUGH BASE.

The frames are erected upon this floor, and held with bolts. The simplest method of erection is to hold one side in position by nailing to it a couple of struts to rest on the ground. Place one adjacent side against it and fix the two together with a couple of handscrews or cramps. Bolt holes can then be bored through the two whilst they are together, thus ensuring their being in alignment. Use $\frac{3}{8}$ in. bolts, but make the holes full in size so that there is a certain amount of latitude. When the two are together they will support each other, and the remaining two can be added. Fig. 40 is a section through one corner and shows the bolts. The whole thing is held down on to the flooring with bolts, and the holes for these are bored after the frames are in

position. Boring the holes through the two ensures alignment. Do not put the holes at the corners, as the bit would foul the brick foundations.

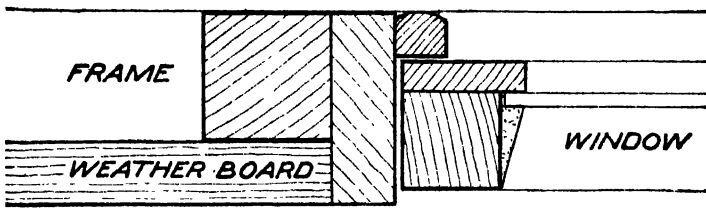


FIG. 42.—PLAN SECTION THROUGH WINDOW.

The door and window linings follow. Fig. 42 is a section through the window. If the frames are being made, lengths of $1\frac{1}{2}$-in. square stuff can be

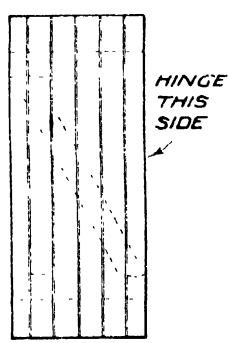


FIG. 43.—DETAILS OF DOOR.

put together with halved joints. Wider battens are then fitted to the inside to form a rebate for the glass. The outer pieces are butted together. This method is not so strong as the mortise and tenon joint, but it is a reasonable substitute for a cheap job. The boarding is straightforward. Each boarding finishes off level with the framework to which it is

fixed, and a batten is nailed in the corner as in Fig. 40. This covers the end grain.

The roof consists of four to six purlins or sloping rails of 2 in. by 2 in. stuff covered by $\frac{3}{4}$-in. matching. It is held down with bolts and is covered with roofing felt fixed with clout nails. 1-in. by $\frac{1}{4}$-in. strips are nailed on top through to the rafters to hold it.

All woodwork should be either painted or creosoted as a protection against weather.

Garden carpentry may be rougher than cabinet work, but that doesn't mean that you can be careless.

If a shed roof leaks, put it right straightway. Otherwise you will have something else to put right as well.

Paint your outdoor woodwork periodically; it will last twice as long.

Nails are invaluable in carpentry, but remember that they do not take the place of a joint.

CHAPTER V

SMALL ITEMS TO MAKE

§1. CLOTHES-AIRER

A dwarf clothes-airer may be either two-fold or three-fold, and anything from 3 feet to 4 feet high. The cutting list for each fold is :—

	Length.	Width.	Thickness.
2 Uprights . . .	4 ft.	1½ in.	⅞ in.
3 Rails . . .	2 ft. 3 in.	1 „	⅞ „

The bottom rail may stand 12 in. from the floor, whilst the upright projects about 2 in. above the top rail. The top edge of each rail is comfortably rounded, and the tops of the uprights are also eased to roundness.

Two alternative types of rail are shown. That at *A* (Fig. 2) is ⅞ in. thick and tenoned to the uprights. A simpler type is shown at *B*. Here the rail is only ⅜ in. thick, with a flush shouldered tenon which will be wedged. If a hardwood is used, the ⅜ in. thickness is sufficiently strong for an airer not exceeding 27 in. in width. As clothes-airers are subjected to damp and heat, it is wise to wedge all the tenons. Test carefully to see that the frames are not in winding after glueing up.

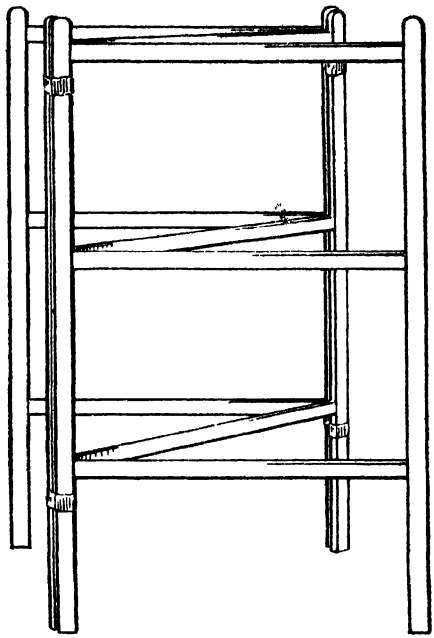


FIG. 1.—SIMPLE 3-FOLD CLOTHES-AIRER.
If preferred it could be made with two folds only.

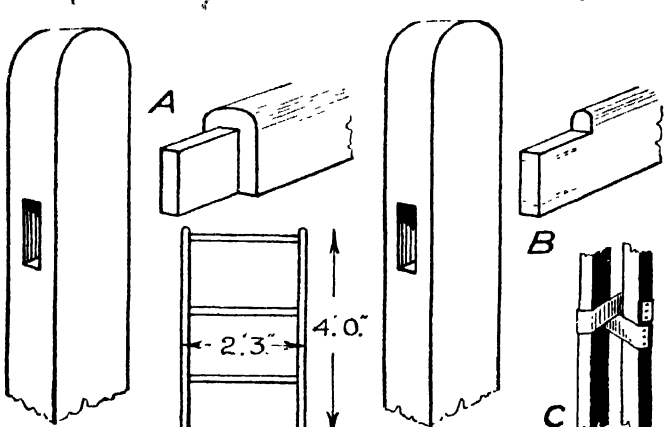


FIG. 2.—DETAILS OF JOINTS AND SIZES OF CLOTHES-AIRER

For the tape hinges (*C*) use stout tape from 1½ in. to 2 in. wide. The simple method of fixing can be followed from the illustration. The tape is folded over where tacked.

§ 2. MODERN STYLE PLATE RACK

This type of rack is vastly more convenient than the old square kind with vertical bars through which

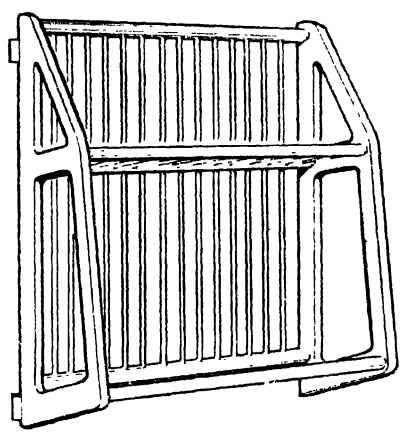


FIG. 3 MODERN STYLE PLATE RACK.

plates had to be passed. The dowels are at the back and shelves only, this making the rack much more convenient in use, and easily cleaned. Only the ends are painted, the rails and dowels being left in the white.

For the ends use either block board, multi-ply, or chipboard, ½ in. thick. Set out the shape of one to the sizes in Fig. 4, and cut out. The interior

piercings can be sawn with a coping saw or bow saw, holes being first bored at the corners to enable the saw to be started. Incidentally, too, the holes make nice rounded corners. The six rails are 1-in. squares planed to octagonal shape, and are jointed to the ends with mortise-and-tenon joints. It makes a

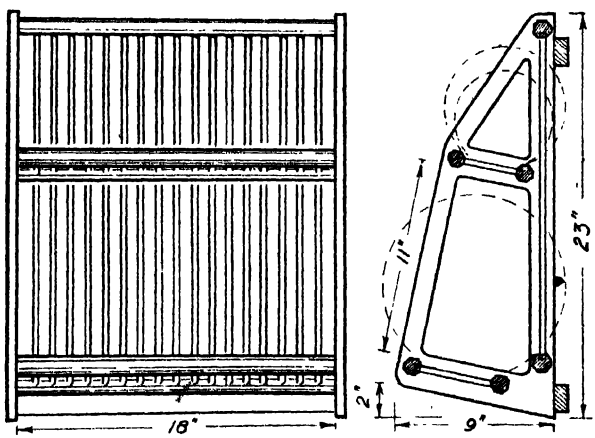


FIG. 4.—ELEVATIONS OF PLATE RACK, WITH SIZES.

stronger job if the tenons are taken right through and are wedged at the outside. Cut the mortises, and pencil-round all the outer edges of the ends.

Prepare the rails to square section and mark the tenons at the ends. Holes to take the $\frac{3}{8}$-in. dowels are needed, and obviously these must all be in alignment. The best way is to step out the required number on one rail, using dividers. A certain amount of trial-and-error stepping is required. When satisfactory cramp all six rails together with the shoulders exactly level, and square the dowel

marks across all. A marking gauge set to the centre of the wood is used to cut each line. As many holes have to be bored, and because it is essential that they are all the same depth, it is advisable to use a depth gauge on the bit. When all are completed plane off the corners of the rails so that the octagonal shape is formed.

The whole is now ready to assemble. There is no

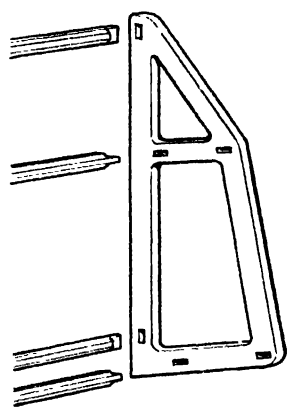


FIG. 5.- HOW RAILS ARE JOINED TO ENDS.

need to glue the dowels, but the tenons must be glued, of course. Put the back and shelves together independently (all the sets of dowels must clearly be to the same length) and add the ends, gluing the tenons. Cramp if possible and knock in wedges at the outside. The cramps must be clear of the rails, of course, as otherwise it would be impossible to drive in the wedges. When the glue has set the tenons can be bevelled at the ends and the two back rails screwed on. These are useful, not only for fixing to

the wall, but to bring the whole forward, thus giving clearance for the plates (see Fig. 4).

CUTTING LIST

	Length.	Width.	Thickness.
2 Ends . . .	1 ft. 11½ in.	9¼ in.	½ in
6 Rails . . .	1 ,, 7½ ,,		1 in. sq.
2 ,, . . .	1 ,, 7½ ,,	1⅝ ,,	⅞ ,,
17 Dowels . .	1 ,, 6½ ,,		¾ in.
17 ,, . .	5 in.		⅞ ,,
17 ,, . .	4 ,,		⅞ ,,

§ 3. FOLDING IRONING-TABLE

To make it sound, a good solid top board (A) of ¾ in. or ⅞ in. is required, one end being pointed as

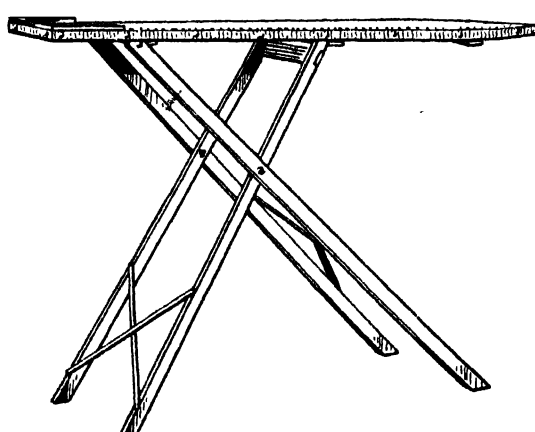


FIG. 6.—SIMPLE FOLDING IRONING-TABLE.

shown and the edges gently rounded, for the table shown in Fig. 6. At the square end (where the iron may rest) the board is covered with a sheet of

asbestos, held down by $\frac{3}{8}$-in. by $\frac{1}{4}$-in. strips (*B*, Fig. 7). The board otherwise is covered first with a piece of old blanket, and later with a piece of calico.

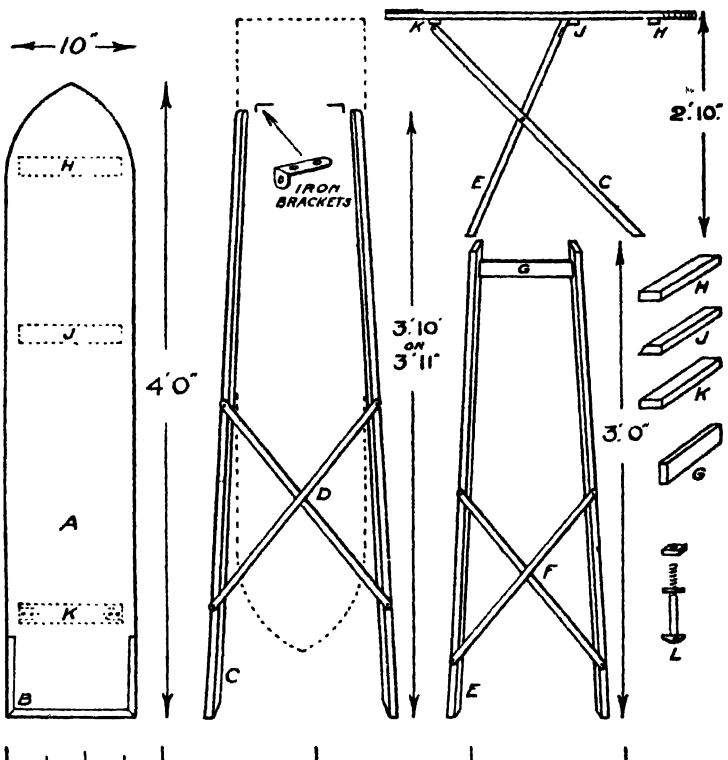


FIG. 7.—SIZES AND CONSTRUCTION OF IRONING-TABLE.

The material is strained to fold over the edges and is neatly tacked, preferably with brass-headed nails.

The folding stand calls for two frames, one 3 ft. 10 in. or 3 ft. 11 in. long, the other 3 ft. long. The shorter frame is adjusted in width so that when

pivoted with iron bolts it will fold within the legs of the longer frame. The sizes may be taken from the scale, but must be carefully tested in the actual making. The legs (*C* and *E*) may be of 1½-in. by ⅞-in. strips, whilst the cross bracing laths (*D* and *F*) may be ⅝ in. by ⅜ in., the strips being halved where they cross. The strips should be of hardwood.

The longer outer frame has a pair of small iron angle-brackets pivot-screwed to the inner faces of legs at top, these brackets being screwed later to the batten (*K*) under the top board. The shorter inner frame has a top rail (*G*) let into the legs and screwed. The exact point for pivoting the frames must be determined when assembling. The reader will find it of great help to make a working drawing of the elevation (see Fig. 7) to half size. When the height to table top (say, 2 ft. 10 in.) has been determined, he may then take two thin laths of the required length, lay these crosswise on the drawing, and adjust them till he gets them in the right position. The point for the pivot bolts is then struck, and the drawing can be completed. An important advantage of the drawing is that the correct bevels at the floor end of the legs and the bevel at the top of legs (*E*) may be marked.

K is the batten to which the folding stand is hinged by means of the iron brackets, and should be of ⅞-in. hardwood. The batten (*J*) acts as a stop for the shorter frame. The third batten (*H*) is necessary to keep the top board out of winding, but has no connection with the folding frames. To secure the top board when the article is in use, it is well to screw

a brass hook to the rail (*G*) of shorter frame, this to engage an eye screwed into the batten (*J*) against which the frame rests. The centre pivot bolts (*M*) may be 2 in. long by $\frac{1}{4}$ in. diameter, each provided with a washer and nut.

CUTTING LIST

	Length.	Width	Thickness
(*A*) Top board	4 ft. 0 in.	10 in.	$\frac{3}{4}$ in.
(*B*) Strip for ditto	2 „ 0 „	$\frac{3}{8}$ „	1 „
(*C*) Two legs	4 „ 0 „	$1\frac{1}{2}$ „	$1\frac{1}{2}$ „
(*D*) Two strips	2 „ 0 „	$\frac{3}{8}$ „	$\frac{3}{4}$ „
(*E*) Two legs	3 „ 2 „	$1\frac{1}{2}$ „	$1\frac{1}{2}$ „
(*F*) Two strips	1 „ 7 „	$\frac{3}{8}$ „	$\frac{3}{4}$ „
(*G*) Rail	9 in.	$1\frac{1}{2}$ „	$\frac{3}{4}$ „
(*H*, *J*, *K*) Three Battens	9 „	$1\frac{1}{2}$ „	$\frac{7}{8}$ „

Lengths allow for joints, but width and thicknesses are net.

§4. TRAYS

For the base of a tray either solid wood or plywood can be used. The latter has the advantage of being stronger across the grain and being free from shrinkage. On the other hand, the layers show at the edges, and this makes it desirable to fit a rebated or grooved edging so that these are hidden. Various ready-made mouldings can be obtained—those, for instance, shown at *B*, Fig. 9—but they have now become somewhat out of date. The corners are mitred together and the panel is screwed on beneath.

An altogether more attractive suggestion is that at *A*, Fig. 9. In this the edging is made up of three strips of wood glued together. Assuming the edging

to be $\frac{7}{8}$ in. high, three pieces of $\frac{3}{16}$-in. or $\frac{1}{4}$-in. wood are planed up and glued together. The two outer pieces might be of oak and the inner one of walnut, though many other combinations are possible. They should be pressed tightly together with thumb-

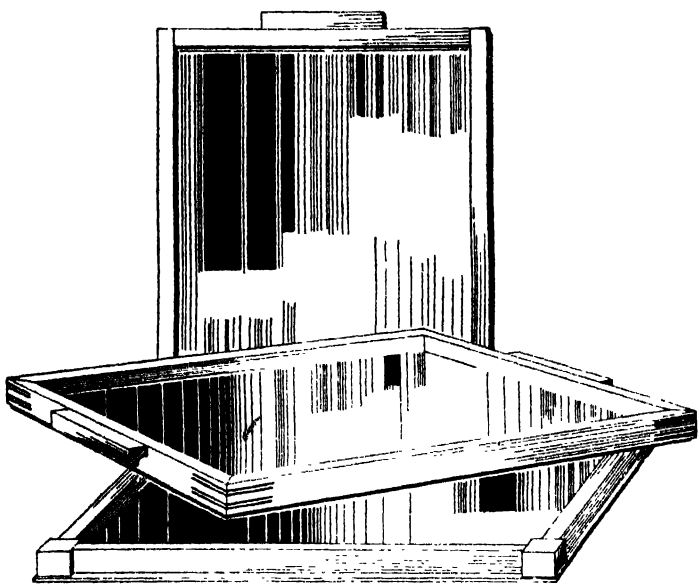


FIG. 8.—MODERN TRAYS WITH SQUARE EDGINGS.

screws. When set, the edges are trimmed and a wide bevel is worked down as far as the inner piece, as shown at *A*, Fig. 9. In this way an attractive inlaid effect is produced. Care must be taken to make the bevels of the same angle and depth in all four pieces.

The corners are mitred together, the opposite members being of exactly the same length. The

joints are cut on the mitre block. When putting them together, the joints are glued and the pieces placed in position on a flat board. A piece of string is passed round the whole and tied tightly. By inserting little blocks of wood between the string and the wood and pushing them towards the corners, the joints are pressed tightly together. When dry,

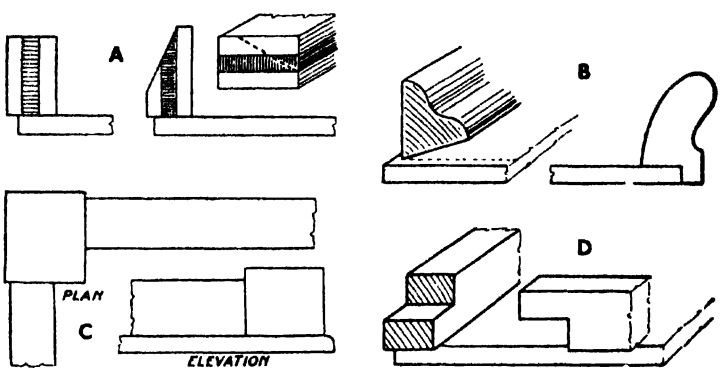


FIG. 9.—VARIOUS FORMS OF TRAY EDGINGS.

A. Inlaid effect produced by jointing up and bevelling.
B. Ready-made mouldings for edgings.
C. Use of corner blocks to avoid mitreing.
D. Simple halved joint for corners.

the bottom edges can be levelled if necessary. Either solid wood or veneered plywood can be used for the panel. The former is the better if quite seasoned. It may be necessary to joint together two or more pieces. The panel stands in all round and is screwed to the edging from beneath. The handles could be blocks of wood cut to one of the shapes suggested in Fig. 11. They are glued and held with a couple of screws driven through the

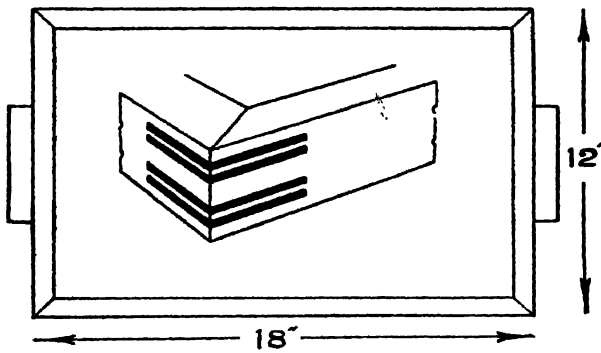


FIG. 10.—CORNERS STRENGTHENED WITH KEYS. These give an inlaid effect.

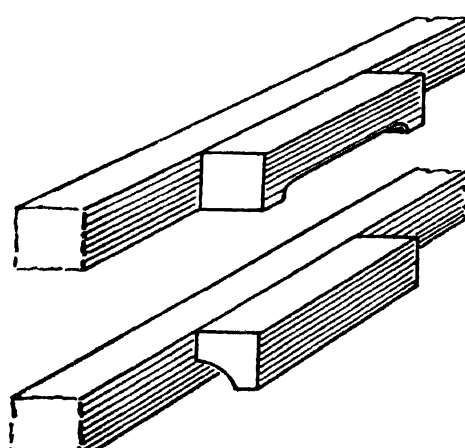


FIG. 11.—SIMPLE WOOD HANDLES.

edging. It is advisable to polish the panel before fixing it.

If it is desired to avoid mitreing, the simple method given at *C*, Fig. 9, can be followed. At the corners are fixed blocks of wood, and the edging is butted between these. All the parts are screwed on from beneath. The top edge of the edging could be rounded, or a couple of inlay strings could be let in to take off the plainness. Another suggestion for the corners is the halved joint at *D*, Fig. 9.

Another attractive tray is given in Fig. 10. The edging is about $\frac{7}{8}$ in. high by $\frac{1}{2}$ in. wide, and the corners are mitred. After it has been glued up, a series of four saw-cuts is made diagonally, and slips of dark veneer or thin wood are glued in. Care must be taken to make all the cuts of equal depth and to avoid allowing the saw to emerge at the inner corner. These slips not only give an enriching touch, but they also strengthen the joints. The panel could stand in a trifle and be screwed on beneath.

§ 5. BOOK ENDS

There is no construction required for any of these designs. They consist simply of various shapes decorated with inlay lines. To the bottom edge a piece of sheet metal is fixed. The books rest upon this, and so the ends are held upright.

The first design would look well in any dark hardwood. If a piece of Cuban mahogany is available this would be excellent, but a light-coloured hardwood could be used and ebony inlay lines used

instead of boxwood. Cut the two pieces square to the overall size of 6½ in. by 5 in. and inlay the four lines. There are various ways of forming the grooves. One is to cramp a straight-edge against each position in turn, and work a tenon saw or dovetail saw along it, using a saw which makes a kerf of the width needed for the inlay. If care is taken to keep the saw well up to the straight-edge a perfectly clean groove is formed. Stop slightly short of the depth of the inlay

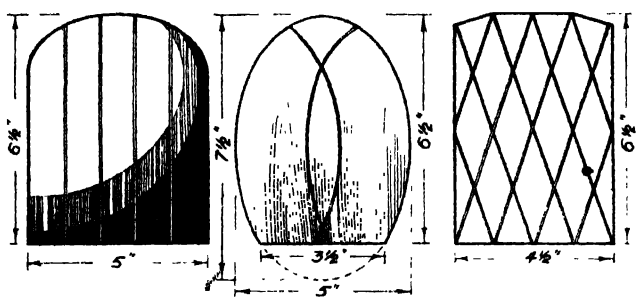


FIG. 12.—ALTERNATIVE DESIGNS FOR BOOK ENDS.

so that when the back of the hammer is pressed over the surface it bears on the inlay, not the surrounding wood. Another way is to use the scratch-stock with a cutter filed to the inlay width. This is worked up against the edge of the wood, and the best plan is to work the outer grooves from their near edges, and then do the inner grooves in the same way.

Cut the inlay slightly full in length, give a coat of hot glue, and immediately press in with the cross peen of the hammer. Leave for twenty-four hours to set, and then clean up the surface with the scraper, followed by glasspaper. One half of the elliptical

shape is drawn on card and the outline cut. By reversing this the both halves can be marked.

For the second design it is necessary to cut out a template in plywood or thin metal of the shape. This is used not only to mark the outline but also as a guide when making the inlay grooves. Cut the wood square in the first place, draw a centre line, and mark the outline on each side of this. Before cutting the shape work the inlay grooves. Cramp the template in position and scratch the groove with a

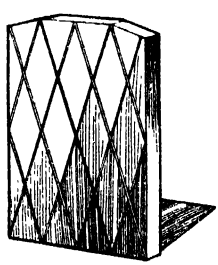


FIG. 13.—SIMPLE DESIGN WITH INLAY LINES FORMING CRISS-CROSS PATTERN.

tool such as a bradawl filed to the required width. Cut one groove, glue in the inlay as in the previous example, and leave to set. The second groove can then be scratched and the inlay glued in.

A similar idea is followed in the last example. All the grooves sloping in one direction are worked first and the inlays glued in. The surface is then levelled and the second set of grooves worked. Either the saw or the filed tool can be used for the grooves.

Finish is best in natural colour followed by light polishing then waxing. If it is necessary to darken the wood use bichromate of potash, as this will darken mahogany, walnut, or oak without affecting the light inlay.

Fig. 14 shows a book-trough that is interesting to make and of attractive appearance. Oak is the most suitable wood to use. The best way of making it is to cut either a series of mortises or grooves in the sides, and corresponding tenons or projections on the back and bottom. The simpler alternative is

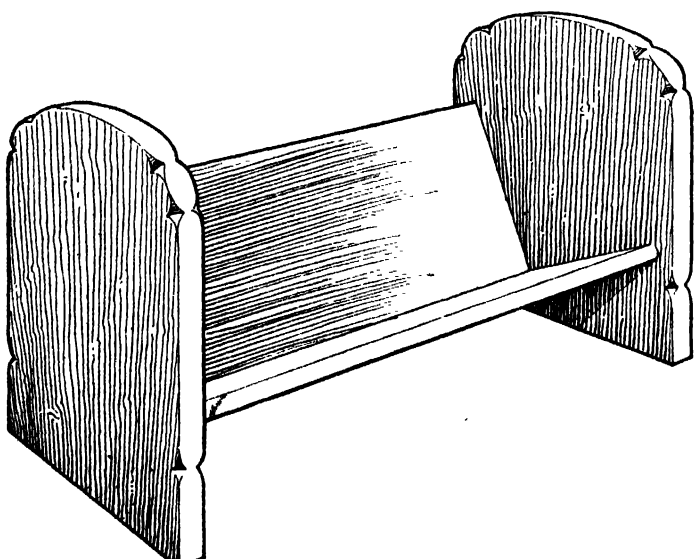


FIG. 14.—BOOK-TROUGH IN OAK.

simply to butt the parts together, fixing them with glue and nails.

The first step is to cut out the sides to the sizes given in Fig. 15. The top shape can be plotted out by drawing in squares and copying the curve in the manner of map-drawing. If a bow-saw is available, this can be used to cut the curve. Failing this, a tenon-saw can be used by making a number of straight

cuts as close up to the line as possible. The corners can be chiselled away and the shape finished with the spokeshave. The position of the back and bottom is drawn in, using a square, and if mortises or grooves are used, these can be cut.

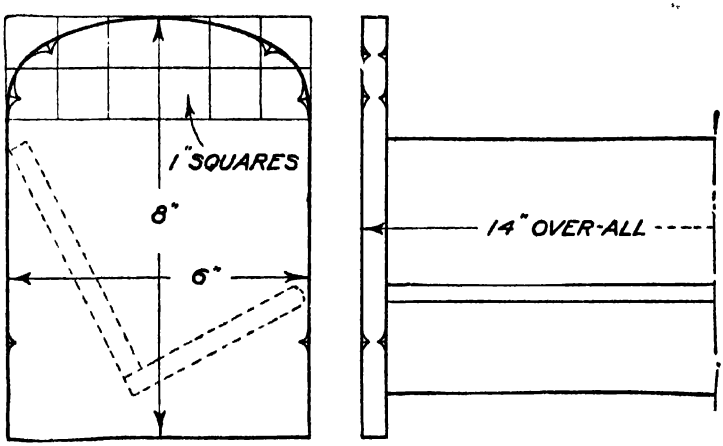


FIG. 15.—END VIEW AND FRONT ELEVATION.

The back and bottom are squared up both to exactly the same length. Tenons can be cut if needed, or, in the event of grooves being cut in the sides, a shoulder can be cut at top and bottom to give a neat finish. In either case remember to allow extra length for the joints. When being butted they are merely planed square at the ends.

The decoration at the edges of the sides is done entirely with the chisel. Pencil in the positions of the recesses, and make a deep cut with the chisel at the centre of each. The chisel edge, of course, lies across the grain. Now ease away the wood

first at one side and then at the other. At the start of the cut the chisel lies almost flat, and the handle is raised as the cut proceeds so that it cuts the curve. Take care to keep both edges balanced. The decoration could be omitted entirely if preferred.

The back and bottom are now screwed together from beneath. When joints have been cut, the parts are cramped together. If they are to be nailed, lines should be drawn at the outside of the sides as a guide for the nails. The last named should have small heads, and they should be "dovetailed" to give a firm grip. Finally the whole thing is waxed.

CUTTING LIST

	Length.	Width.	Thickness.
2 Sides	8¼ in.	6½ in.	⅛ in.
1 Back	13¾ ,,	5⅛ ,,	⅜ ,,
1 Bottom	13¾ ,,	4 ,,	⅜ ,,

The above sizes allow for joints.

§6. VENEERED CLOCK CASE

For the reader who has a suitable movement this makes a delightful case. The original dial can be removed and the hands replaced on the new case. Depending upon the particular movement, it is likely that the back of the new wood dial may have to be recessed at the inside. Otherwise there may not be sufficient clearance for the hands owing to the limited length of the spindles. This recessing is shown in the side section in Fig. 17.

Various methods of construction can be used for

the case. At (*A*) Fig. 17 both top and bottom are lap-dovetailed. A simpler alternative is that at (*B*), which consists of a plain lapped joint which is glued and nailed together. In many respects the alternative at (*C*) is the best for an item to be veneered. A plain mitre is planed and the parts glued together. When the glue has set saw cuts are made at an angle across the joint and slips of veneer glued in the kerfs. If this construction is followed the bottom corners

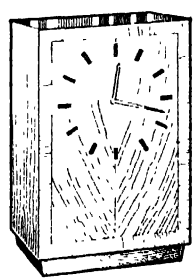


FIG. 16.—CLOCKCASE WITH VENEERED FRONT AND INLAID PIPS.

can be either lapped as at (*B*) or dovetailed (*A*). The advantage of this mitred joint is that it is less liable to show any disturbance through the veneer owing to unequal shrinkage such as is liable to appear in the case of (*A*).

Having assembled the sides, top, and bottom, the front and back edges are levelled and the wood for the front glued on. This latter piece must be well seasoned, as otherwise it may shrink and split. If any recessing at the inner surface is needed, this must be done beforehand, of course.

Veneering now follows. Do the sides first, and

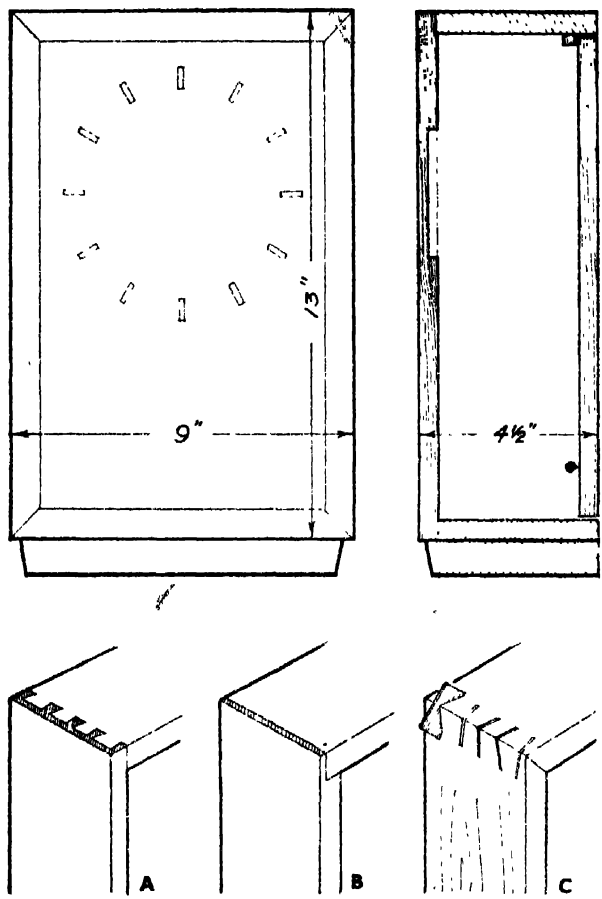


FIG. 17.—FRONT ELEVATION, SIDE SECTION, AND ALTERNATIVE JOINTS FOR TOP CORNERS.

when the glue has set level the top and bottom and apply the top veneer. For a small job of this kind the simplest method of veneering is to cramp a flat block over the veneer. A piece of newspaper is interposed to prevent the glue from sticking to the block, and the latter is heated to liquefy the glue, so enabling it to be pressed out.

The glue having set, level the overhanging veneer and deal with the front. This can be halved, as shown in Fig. 16, or quartered. Alternatively, a single piece of richly figured veneer can be used. If the built-up pattern is preferred, it should be made up beforehand and put down in one operation—or if preferred the main panel can be made up and laid and the cross-banding applied afterwards. The advantage of the latter is that the banding is bound to be of exactly equal width throughout, since the cutting gauge is used to cut away the banding area. If this is done the block holding down the veneer can be removed after about an hour and the cutting gauge run around the edges. This enables the waste to be peeled away easily before the glue sets. In this case the main panel of veneer should stand in slightly all round to enable the gauge to be used. If the other method is followed and the banding fitted around the panel before laying it should project slightly all round to allow for trimming afterwards. In either case exact positioning of the veneer is essential so that the centre joint is exactly in the middle.

The pips should be in a light contrasting wood, and can be of various shapes. Mark out the main circles

with compasses and carefully set the angles at which the pips are to be fitted, all lines being radial. A good plan is to nick in the ends with a narrow chisel then tap a nail into the centre where the hand spindles are to go. A steel straight-edge kept up against this and held against each mark enables a cut to be made with a keen chisel in the correct direction. Lift away the waste veneer and glue in the pieces to form the pips. If preferred they can go deeper than the veneer thickness. Glue in and leave for as long as possible—twenty-four hours is a minimum—before cleaning up.

The base can be a solid piece screwed on. For the back a single piece is used, this being hinged at one side and a small knob fitted at the other. To prevent it from being pushed in too far a small strip is glued and nailed beneath the top as in the section in Fig. 17.

CUTTING LIST

	Length.	Width.	Thickness.
2 Sides . . .	1 ft. 1¼ in.	4⅛ in.	½ in.
2 Top and bottom .	9¼ in.	4⅛ ,,	½ ,,
1 Front . . .	1 ft. 1¼ in.	9¼ ,,	½ ,,
1 Back . . .	1 ,, 1¼ ,,	8¼ ,,	½ ,,
1 Base . . .	9 in.	4½ ,,	¾ ,,

§ 7. TABLE LAMPS

Construction is fairly obvious in all examples. The only possible difficulty is that of boring to take the wiring flex. With care this can be done half-way in from each end, and the best plan is to ask an assistant to stand to one side to note whether the brace is being

held upright. A simpler alternative is to make the stem in two pieces, these being grooved along their length beforehand. This is shown in Fig. 19. An

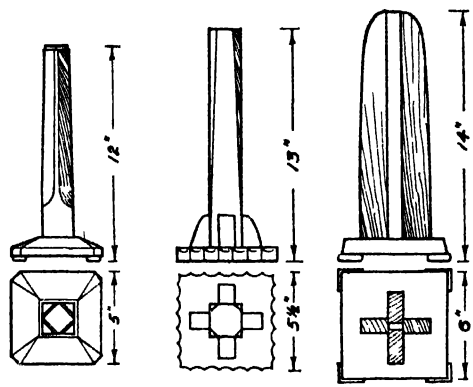


FIG. 18.—THREE SIMPLE DESIGNS, ALL OF WHICH CAN BE WIRED FOR ELECTRICITY.

exception is in the third design, in which the four pieces are arranged as in Fig. 20, leaving a centre space through which the flex can pass. In all cases the stem is tenoned into the base. A single tenon is cut

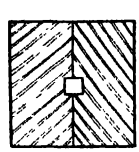


FIG. 19.—TWO HALVES OF PILLAR GROOVED AND JOINTED.

in the first two examples as in Fig. 21, but in the third design each of the four pieces has a separate tenon. In each design the main structural work is done before any decorative detail is added.

Taking the first design, prepare the two pieces to form the stem. The finished thing is $1\frac{3}{4}$ in. square, and each piece must therefore be $\frac{7}{8}$ in. thick. Plane a good joint and plough a $\frac{1}{4}$-in. or $\frac{5}{16}$-in. groove along the centre of each. Place a piece of oiled string in the groove and glue the parts together, using cramps if possible. Drag the string back and forth a few times, so making sure that the hole is clear.

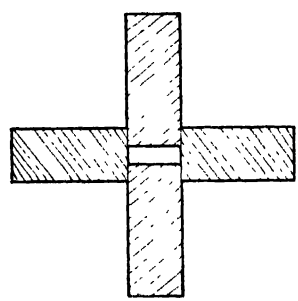


FIG. 20.—HOW FLEX GROOVE IS FORMED IN THE THIRD DESIGN.

Mark out and cut the tenon to fit into the base (Fig. 21).

For a distance of about two-thirds the length plane a taper so that at the top it finishes $1\frac{1}{2}$ in. The corners are then chamfered as shown, this being done partly with chisel and partly with spokeshave. Finish off with glasspaper held around a flat block.

The base is prepared square, the mortise cut, and the edges chamfered. Afterwards the corners are taken off and the chamfers continued on these. The feet can be cut from odd scraps.

In the second design the stem is not tapered, but

a lightening effect is obtained by working tapered chamfers at the corners. The base is given a fluted effect by cutting the hollow shapes either with a broad gouge or working them with a half-round file followed by glasspaper. To hold the small buttress pieces secure shallow grooves are cut to receive them in both stem and base. If both the grooves and the ends of the buttress pieces are cut at 45 degrees the latter can easily be added after the stem has been glued in position.

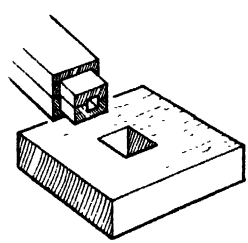


FIG. 21.—METHOD OF TENONING PILLAR INTO BASE.

When making the stem of the third design cut the four pieces square and straight and cut the tenon at the end. Saw the shape and finish the curve with spokeshave, followed by glasspaper. To assemble place between the two wider pieces a strip of wood planed to finish $\frac{1}{4}$ in. thick, the edges of which have been oiled. Glue the third piece to that it is attached to both pieces and has the same overlap on both. After about an hour remove the oiled strip, and add the fourth shaped piece to the other side. Care must obviously be taken for all ends to be level. Fit as a whole into the base, glue in, and add the four feet.

CUTTING LISTS

	Length.	Width.	Thickness.
Design 1.			
2 Stem pieces .	1 ft. 0¼ in.	2 in.	⅞ in.
1 Base . . .	5¼ in.	5¼ ,,	1 ,,
Design 2.			
2 Stem pieces .	1 ft 1¼ in.	2 in.	⅞ in.
1 Base . . .	5¾ in	5¾ ,,	¾ ,,
4 Blocks . .	2¼ ,,	1¼ ,,	⅞ ,,
Design 3.			
2 Stems . .	1 ft. 2 in.	2 in.	¾ in.
2 ,, . .	1 ,, 2 ,,	1¾ ,,	¾ ,,
1 Base . . .	6¼ in.	6¼ ,,	¾ ,,

Working allowance has been made in lengths and widths. Thicknesses are net. Small parts such as feet are cut from odd scraps.

CHAPTER VI

DESIGNS FOR FURNITURE

§ 1. OAK STOOL WITH HINGED LID

THE stool in Fig. 1 is Tudor Gothic in style, and is designed specially for simplicity of construction. A useful box portion is arranged beneath the lid, and this should prove handy for oddments.

First prepare the two trestle ends or legs from $\frac{7}{8}$-in. oak. They can be cut out first in the form of rectangles, $13\frac{1}{4}$ in. by 10 in. Having planed the edges square, the taper of the sides can be marked so that the top is 8 in. wide. The shape of the bottom can also be marked by drawing in the 1 in. squares and plotting the curves map fashion as at *B*, Fig. 1. The shaped lines can be cut with the bow-saw or keyhole-saw (the former preferably), and be finished off with spokeshave and rasp. The straight sides can be sawn away and finished with the plane. To enable the front and back to be fitted in flush, the edges of the legs are cut as shown at *B* and *C*. A depth of $\frac{7}{8}$ in. is cut in, this being the thickness of front and back.

Now proceed with the last-named, cutting them

FIG. 1.—SIMPLE STOOL WITH HINGED LID.
A. The completed stool.
B. Front and side elevations.
C. How the parts fit together.
D. Method of recessing the screws.

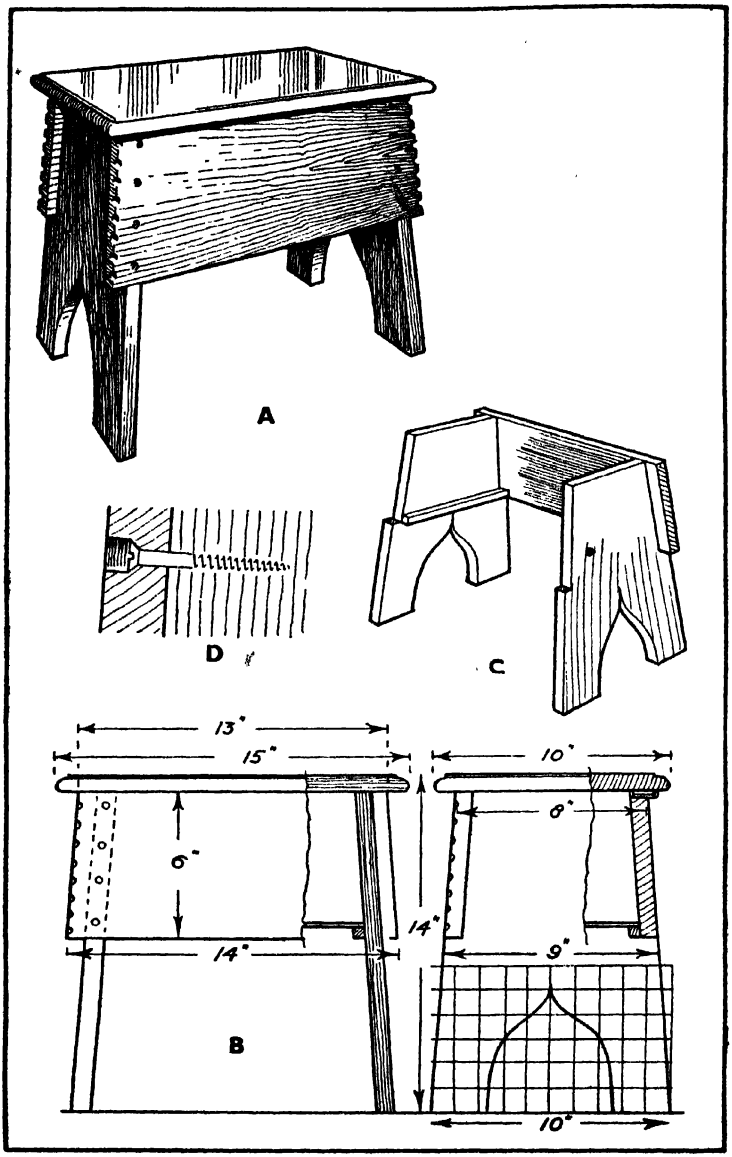


FIG. 1.

from $\frac{7}{8}$-in. oak to finish 14 in. by a trifle over 6 in. The ends slope inwards so that at the top they measure 13 in. In the first place, however, it is better to make the pieces square. When the edges are trimmed the simple gouge-cut decoration can be made at the ends.

CUTTING LIST

	Length.	Width.	Thickness.
2 Legs	13½ in.	10⅛ in.	⅞ in.
2 Pieces (front and back)	14¼ ,,	6¼ ,,	⅞ ,,
1 Top	15¼ ,,	10⅛ ,,	⅞ ,,
1 Bottom	11½ ,,	7⅜ ,,	¼ in. ply
2 Fillets	11½ ,,	½ ,,	½ ,,
2 ,,	7¼ ,,	½ ,,	½ ,,

1 Pair 2-in. butt hinges.
About 18-in. brass chain.

As the parts are fixed together with screws, a series of screw-holes must be bored parallel with the sloping ends. The screws are recessed as at *D*, and the best plan is first to bore holes large enough to take the screw-heads and passing in about one-third of the thickness. Holes for the shanks can then be bored.

The parts can now be tried together, and it will be found that the joints will be a trifle open at one side owing to the splay of the side and legs. This necessitates the edges of the notched portion of the legs being planed away at a slight angle. The amount is easily marked with a pencil when the

parts are together in position. Afterwards the whole can be screwed together finally.

The top edges of all the parts will need to be planed to make them level. If left square they will necessarily slope inwards owing to the angle of the parts. This is easily done after they are together, since the plane, in resting on the adjacent side, is necessarily held at the required angle. The bottom ends of the legs must be planed similarly. For the bottom a piece of $\frac{1}{4}$-in. plywood can be used. This is planed so that it can be entered from beneath and be recessed sufficiently for the $\frac{1}{2}$-in. fillets to be fixed around as at *B* and *C*.

The lid is hinged. The moulded edge is an advantage, and is easily worked by making first a rebate level with the top square member. It can then be rounded over partly with the smoothing- and the rebate-planes. The end grain should be done first. Glasspaper held in a hollowed-out rubber will give a good finish. Alternatively the whole edge can be rounded over. Note that the hinges are let in in their entirety into the back, and that the knuckle projects considerably. If this is done, the lid will open to a trifle more than a right angle, so that it will remain open. A pair of chains can be fitted to take the strain if it is knocked backwards. Finally the screw-holes can be filled in with little rounded pieces of oak. This is best done last, in case it should be necessary to withdraw the screws to make any adjustment. The whole thing can be stained and finished with wax.

§ 2. THE LONG STYLE COFFEE TABLE

This long-type table has many advantages. It is suitable for use in front of a settee, and is of the right shape to hold a tray. Furthermore, the available top space is greater than in the square or circular type without taking up too much space in the room. This has a top covered with plastic material which is both heat- and water-mark proof. The table shown in Fig. 2 has a built-up design made from relatively small pieces assembled on a plywood or blockboard

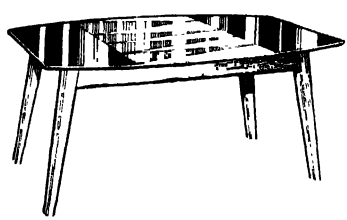


FIG. 2.—TABLE HANDY FOR THE CHAIR SIDE.

top. If preferred a single sheet of plastic could be used.

The framework is unusual in that, although the long side rails are tenoned in the conventional way, the short rails are dovetailed into these long rails as shown in Fig. 4. The legs splay in both directions, though the angle is greater in the length than in the width.

Cut out the legs to finish $1\frac{3}{4}$ in. at the top, tapering to 1 in. at floor level. Marking out can be done economically by cutting two from a single piece 3 in. wide, arranging them top to toe. Clearly the mortises

have to be cut at an angle, and if an adjustable bevel is available this can be set to 80 degrees, measuring from the edge to be mortised (not the outside).

Failing the adjustable square, two pieces of thin wood can be nailed together at the required angle for marking and as a guide for mortising. A haunch is cut on the tenon at the top, as shown in Fig. 4, and

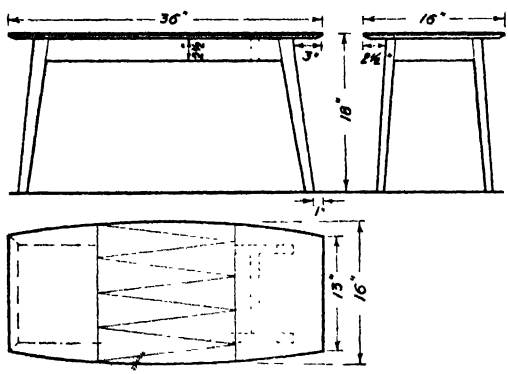


FIG. 3.—ELEVATIONS AND PLAN.

clearly the mortise must be set down from the top accordingly.

The short rails are slot-dovetailed (Fig. 4), and although the slots are cut across square the rail ends are at an angle of 86 degrees, and the dovetail shoulders, being marked with the gauge, are obviously at the same angle. Try the parts together dry, testing to see that the legs are not in winding. When satisfactory, clean up all surfaces which cannot be cleaned after assembling. Glue each long rail to its pair of legs, cramping and fitting tapered wood blocks beneath the cramp shoes. The glue having

set, the joints are levelled and the surfaces cleaned up. Lastly, the dovetailed rails are glued in.

For the top use $\frac{1}{2}$-in. or $\frac{5}{8}$-in. multi-ply. Note that an edging is applied all round. The end ones need

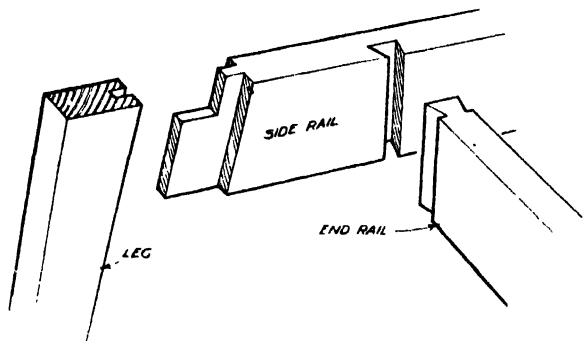


FIG. 4.—JOINTS USED IN CONSTRUCTION OF UNDER-FRAME.

be only 1 in. wide, but at the sides they must be 3 in. wide to enable the shape to be worked. Fig. 5 shows how the edging is fixed with a loose tongue fitting in grooves. The corners can be mitred. Having glued

FIG. 5.—SECTION THROUGH TABLE TOP SHOWING EDGING.

on the edging and levelled the surfaces, the shape is marked along the long sides, a bent lath of wood being used to mark the curve. Note that the mitre reaches to the corner after the shape has been cut, and this must be allowed for marking out.

The shape having been cut and cleaned up, the

design can be marked out and the pieces of plastic cut to shape and fixed down with resin glue. Afterwards the underside is bevelled as in Fig. 5. No finish is needed on the plastic top, but the framework should be French polished. Fix the top with pocket screws driven through the rails.

CUTTING LIST

	Length.	Width.	Thickness.
4 Legs . . .	1 ft. 7 in.	2 in.	1 in.
2 Rails . . .	2 „ 6 „	2¾ „	1 „
2 „ . . .	11 in.	2¾ „	1 „
1 Top . . .	2 ft. 10½ in.	11½ „	½ „
2 Edgings . . .	3 „ 1 „	3¼ „	½ „
2 „ . .	1 „ 2 „	1¼ „	½ „

§ 3. SMALL BOOK-TABLE

The item in Fig. 6 should prove handy to stand by the chair side in the living-room. It is designed so that it can be used from both sides, the top being arranged so that the books can be slid in either side. The lower shelf is handy for magazines and papers. Practically any hardwood could be used, and it is suggested that the plinth be stained a darker shade than the rest. *B* gives the chief sizes, and *C* shows how the parts are joined together.

It will be noticed that the top stands in a trifle and is rounded over. It fits in lapped joints cut in the sides, and these are shown clearly at *C* and *D*. This means that the top must be cut short of the over-all length by the thickness of the laps. This

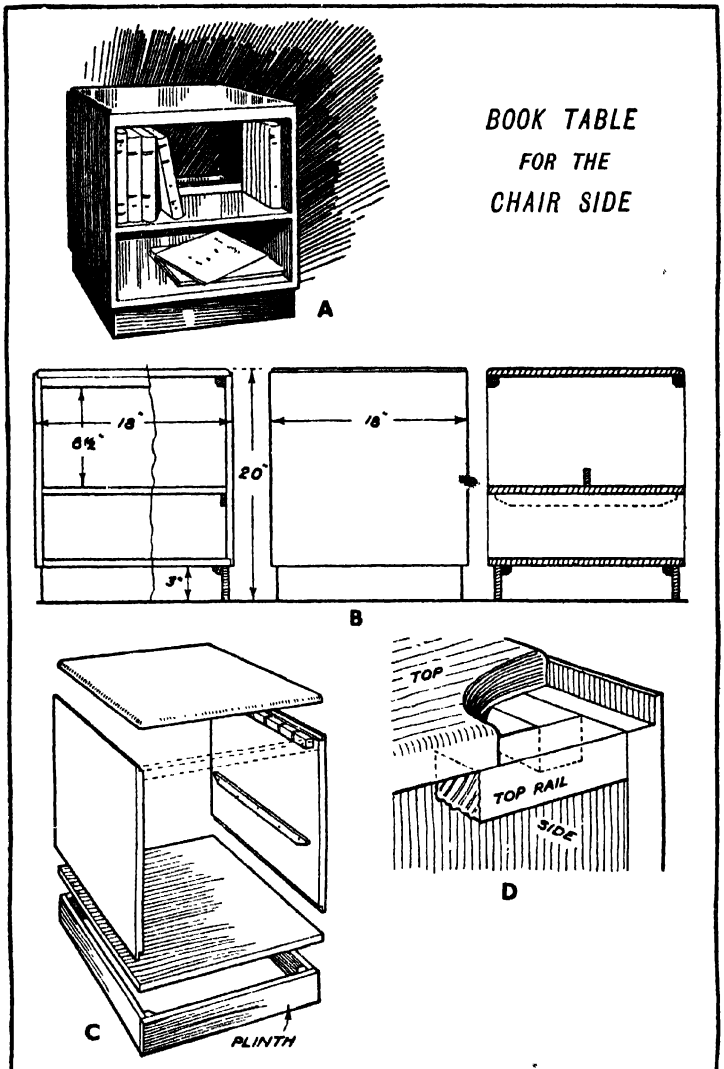


FIG. 6.—ATTRACTIVE SMALL BOOK TABLE FOR THE CHAIR SIDE.

A. The complete table. *B*. Elevations with sizes.
C. How the carcase is made. *D*. Detail of top construction.

might be $\frac{3}{16}$ in., making $\frac{3}{8}$ in. in all. The same applies to the bottom, though this does not project downwards, but finishes flush.

Prepare the two sides from $\frac{5}{8}$-in. stuff to finish $16\frac{3}{4}$ in. by 18 in. Plane the edges square and mark out with the gauge the lapped joints. The lap thickness can be $\frac{3}{16}$ in., and the depth at the top is $\frac{3}{8}$ in., allowing the rounded edge of the top to stand up $\frac{1}{4}$ in. At the bottom the depth is $\frac{5}{8}$ in. Cut the joints by sawing across the grain and chiselling away the waste. A rebate plane is handy with which to finish off. The four parts are put together with glue and nails, the last named being punched in and the holes filled up with plastic wood.

Beneath the top a rail is fixed as shown by the dotted lines at *C*. It can also be seen at *D*. It is screwed to the top from beneath. Other pieces running from front to back can also be glued in as shown. These are really glue blocks. They are cut up into lengths of about $1\frac{1}{2}$ in., each with about $\frac{1}{16}$ in. gap between so that they do not oppose shrinkage. Fillets are fixed to hold the shelf as at *C*. In the centre of the shelf is a rail 1 in. high to prevent books from being pushed too far in. It is screwed from underneath.

A simple way of making the plinth is merely to butt the corners, glueing and nailing them. Glue blocks in the corners to strengthen them. To fix the plinth, the table is turned upside down and the plinth placed in position. A couple of nails are driven in askew to hold it. Glue blocks are then rubbed in all round as shown in the section at *B*.

CUTTING LIST

	Length.	Width.	Thickness.
2 Sides	17 in.	$18\frac{1}{8}$ in.	$\frac{5}{8}$ in.
1 Top	$17\frac{7}{8}$,,	$18\frac{1}{8}$,,	$\frac{5}{8}$,,
1 Bottom	$17\frac{7}{8}$,,	$18\frac{1}{8}$,,	$\frac{5}{8}$,,
1 Shelf	17 ,,	$18\frac{1}{8}$,,	$\frac{5}{8}$,,
1 Shelf rail	17 ,,	$1\frac{1}{8}$,,	$\frac{3}{8}$,,
2 Top rails	17 ,,	1 ,,	1 ,,
4 Plinth pieces	$17\frac{3}{4}$,,	$3\frac{1}{8}$,,	$\frac{5}{8}$,,
2 Fillets	$17\frac{3}{4}$,,	1 ,,	$\frac{5}{8}$,,

Glue blocks are extra.

§4. PLANT STAND

This makes an attractive and useful item for almost any room in the house. Its length can be varied to suit any special space such as a window recess, and the height too can be made to agree with the window. Frequently such stands are used in showrooms or waiting-rooms, where short, stubby legs give a suitable height.

It consists of a main box which is made up complete in itself and four separate legs which are tenoned to blocks, these in turn being screwed beneath the box. If it is anticipated that plants are to be watered whilst in the box, a metal container can be made to fit inside, but it is not essential if plant pots are merely being stood in the box.

Cut out a bottom to finish 2 ft. 3 in. by 7 in., planing the edges square. They are then planed at an angle to give the sloping sides. If an adjustable bevel is not available two strips of wood can be nailed together and used to test the edges to see that the same angle is maintained.

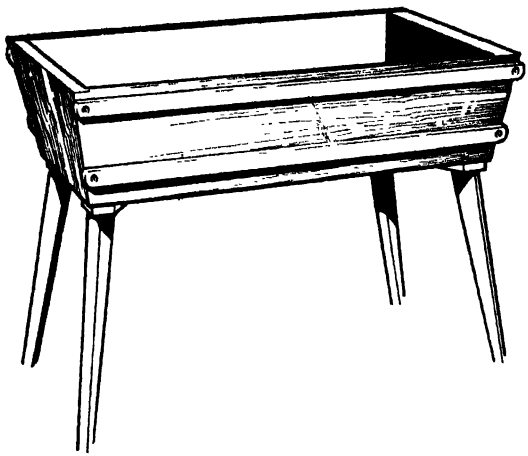


FIG. 7.—PLANT STAND, HEIGHT OF WHICH IS VARIABLE.

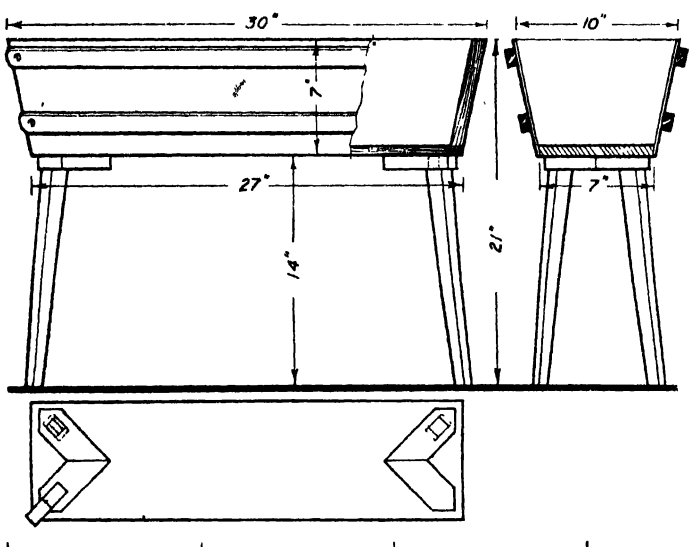


FIG. 8.—FRONT AND SIDE ELEVATION WITH SCALE.

The two ends follow, these being cut and trimmed to the shape given. In this preliminary shaping the edges are planed square, but afterwards the bottom edge should be bevelled to the same angle as the bottom. There is no need to bevel the sides at this stage, as this is more easily done after fixing, though the top edge can be planed to the same angle as the bottom.

Fix the ends with glue and nails, and, when the

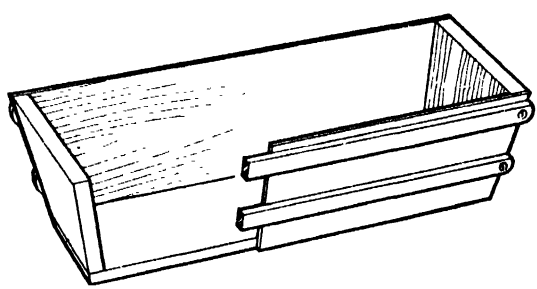


FIG. 9.—CONSTRUCTION OF MAIN BOX.

glue has set, plane the sides to agree with the slope of the bottom. This can be done by allowing the back of the plane to rest on the adjoining edge so that the correct angle is planed automatically. The shape of the sides is ascertained by laying the plywood or hardboard in position and marking round. Fix them with glue and nails and prepare the long rails. These have rounded ends, the length being ascertained by measurement of the box. Fix with screws, preferably raised-head screws fitted into screw cups.

The legs taper from 1½ in. at the top to ⅞ in. at the

bottom. They can be sawn economically by marking them side by side, wide end of one against narrow end of the other. They are tenoned at top to fit into mortised blocks, as in Fig. 10. As the legs are set at an angle, the tenons must also be set at an angle to agree.

Blocks are shaped as in the plan in Fig. 10. The mortises run right through and are cut longer at the top to enable the wedges to force out the tenons and

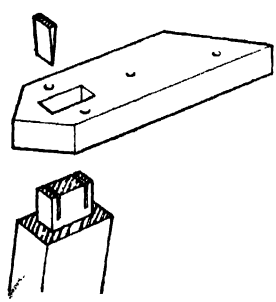


FIG. 10.—HOW LEGS ARE JOINTED TO BLOCKS.

so exert a dovetail grip. Before assembling, the sharp edges are rounded over and the legs finally cleaned up. Fix the blocks with screws as in the plan.

The finish depends upon the woods used and the effect required. One effective way is to polish the legs and blocks black. For this they are stained black and finished with black French polish. For the box portion an attractive treatment is for the long rails to be either lighter or darker than the box itself. The choice depends upon the woods. If there is not sufficient contrast a stain can be used before polishing.

The legs can be marked out economically as described in the article.

CUTTING LIST

	Length.	Width.	Thickness.
2 Sides . . .	2 ft. 6¼ in.	7½ in.	¼ in. ply
2 Ends . . .	7¼ in.	10 ,,	¾ in.
2 Rails . . .	2 ft. 6 in.	1½ ,,	¾ ,,
2 ,, . . .	2 ,, 4½ ,,	1¼ ,,	¾ ,,
1 Bottom . . .	2 ,, 3½ ,,	7½ ,,	¾ ,,
4 Blocks . . .	6 in.	2¼ ,,	¾ ,,
4 Legs . . .	1 ft. 3 in.	1¾ ,,	⅞ ,,

§5. DROP-SIDE COT

An item of this kind is best made in a plain, straight-grained wood and finished with paint or lacquer. Nursery-rhyme transfers can be added as required. The mattress is the standard; 4 ft. by 2 ft. and can be obtained ready-made, or can be made up from a frame halved or tenoned together and covered with canvas or rubber webbing. Special drop-side fittings can be used, and the back can be joined to the sides with the special fittings made for the purpose. The advantages of these is that the cot can be taken to pieces and stacked away flat when not in use.

The main cot parts are made so that the mattress has about ¼ in. clearance at ends and back, and about ¾ in. at the front adjoining the drop-front. Begin with the ends. Two rails are needed, the top one being 4 in. wide to enable the curve to be worked. The mortise and tenon joint for this rail is shown in

Fig. 13. Since the ends of the rail are cut away in sawing the curve, it is clearly necessary to keep the tenon low and to have a wide haunch. The reason for this is made clear from the dotted lines in the elevation in Fig. 12. The lower rail has the tenons the full width of the rail.

Glue the parts together and when set, level the

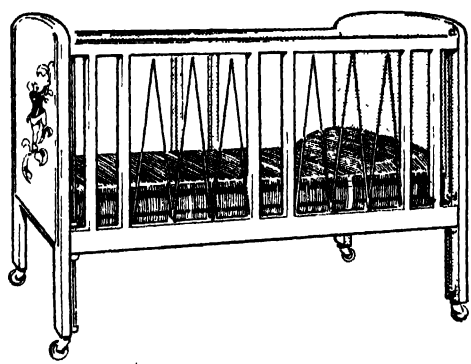


FIG. 11.—DROP-SIDE COT FOR 4 FT. BY 2 FT. MATTRESS.

joints. Mark the curve by means of a strip of wood with a nail driven in as centre at one end, and with a notch 42 in. away in which a pencil can be held. The waste can be sawn away with the bow saw or, if this is not available, two straight cuts with the handsaw can be made, and the final trimming done with the spokeshave or shaper tool. A sheet of plywood or hardboard is trimmed so that it follows the general shape and the edges rounded over with glasspaper. It is fixed with glue and fine nails. The last named should be punched in and the holes filled in with putty or other filler.

Back and front frames are identical so far as general construction is concerned. Alternative designs are shown in Fig. 12. That to the left consists of six uprights $\frac{7}{8}$ in. square tenoned into a $1\frac{1}{2}$-in.

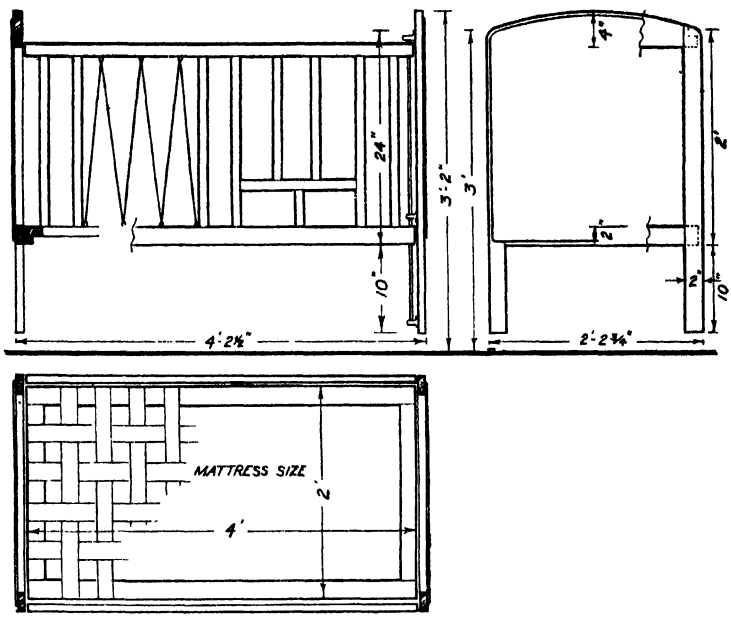


FIG. 12.—ELEVATIONS AND PLAN WITH MAIN SIZES.

top rail and a bottom rail 2 in. wide. Between the uprights are cords drawn taut between screw eyes. The colour of the cord can be chosen to agree or contrast with the colour of the paint work. It can be washed from time to time as required. The second design to the right is a rather more elaborate arrangement of $\frac{7}{8}$-in.-square rails. All are tenoned together. If this second design is chosen the various members should be fixed together temporarily and the shoulder

or mortise marks squared across so that corresponding sizes are exact.

The mortises do not run right through but go in about two-thirds of the distance. The parts are glued together, care being taken to see that the whole is square and free from winding. When the glue has set the edges are taken off with glasspaper—in fact, all sharp edges and corners should be removed so

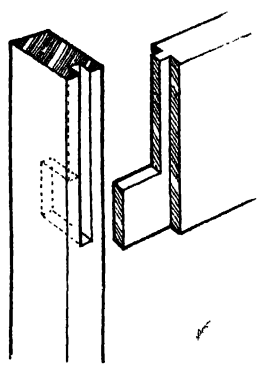


FIG. 13.—JOINT BETWEEN TOP SIDE RAIL AND UPRIGHT.

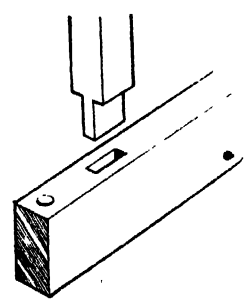


FIG. 14.—HOW UPRIGHT SLATS ARE FIXED TO RAILS OF DROP-SIDE.

that there is no danger of the child being injured. In the case of the back, special metal fittings are used to fix it to the ends. At the bottom are two hooks which fit in slotted plates. Threaded hooks are screwed in at the top to the sides, and holes in the top back rails fit over these hooks. Nuts attached to chains are used to keep the back in position. Thus, to take the whole to pieces the nuts are undone and the back lifted straight off.

The drop-front runs on metal rods screwed to the

posts of the sides. Holes to fit over these rods must be bored through top and bottom rails at the ends. Pivoted hooks keep the side in the up position. To support the mattress a wood strip is glued and nailed to each end.

Finish the woodwork with three coats of paint, priming, undercoat, and final coat. Nursery-rhyme transfers can be added as required.

CUTTING LIST

	Length.	Width.	Thickness.
4 Posts	3 ft. 1 in.	$2\frac{1}{4}$ in.	$\frac{7}{8}$ in.
2 Side rails	2 ,, 2 ,,	$4\frac{1}{4}$,,	$\frac{7}{8}$,,
2 ,,	2 ,, 2 ,,	$2\frac{1}{4}$,,	$\frac{7}{8}$,,
2 Panels	2 ,, 2 ,,	$26\frac{1}{4}$,,	Plywood or hardboard
2 Top rails	4 ,, 1 ,,	$1\frac{3}{4}$,,	$\frac{7}{8}$ in.
2 Bottom rails	4 ,, 1 ,,	$2\frac{1}{4}$,,	$\frac{7}{8}$,,
12 Uprights	1 ,, 10 ,,	$1\frac{1}{8}$,,	$\frac{7}{8}$,,
2 Strips	2 ,, $0\frac{1}{2}$,,	1 ,,	$\frac{7}{8}$,,
2 Mattress sides	4 ,, 2 ,,	$2\frac{1}{4}$,,	$\frac{7}{8}$,,
2 ,, ends	2 ,, 0 ,,	$2\frac{1}{4}$,,	$\frac{7}{8}$,,

The above is for the design with uprights and cords. For the other design the following should be added:

	Length.	Width.	Thickness.
8 Uprights	1 ft. 4 in.	$1\frac{1}{8}$ in.	$\frac{7}{8}$ in.
4 ,,	6 in.	$1\frac{1}{8}$,,	$\frac{7}{8}$,,
2 Horizontals	1 ft. 4 in.	$1\frac{1}{8}$,,	$\frac{7}{8}$,,

§ 6. TEA TROLLEY

The trolley in Fig. 15 can be used either in the living-room or in the garden. It has two useful

shelves, and the legs are fitted with 3-in. rubber-tyred castors to enable it to run easily over carpets. The shelves have an edging at back and sides to prevent things from being pushed off, whilst the

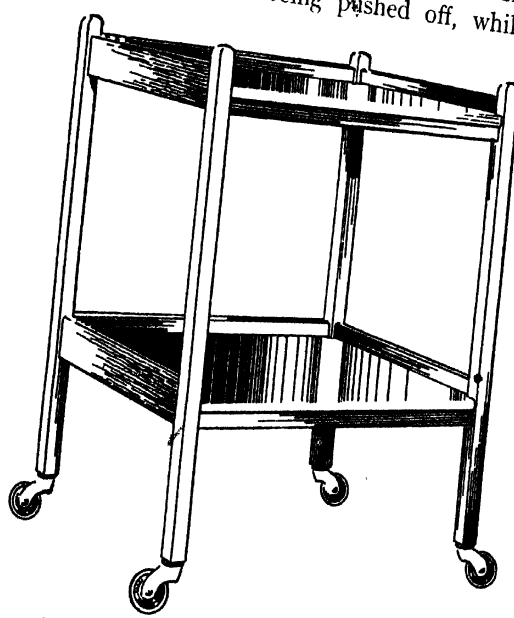


FIG. 15.—TEA TROLLEY OR SERVICE WAGON.
2 ft. 2 in. by 1 ft. 4 in. Height (over-all) 2 ft. 8 in.

front is left clear so that a tray can be easily pushed on. Oak is a suitable wood to use, though actually any hardwood could be used. The shelves are of ½-in. plywood lipped at the front edges. Two methods are suggested for fixing the shelves. The simpler way shown in Fig. 17 is to allow the rails

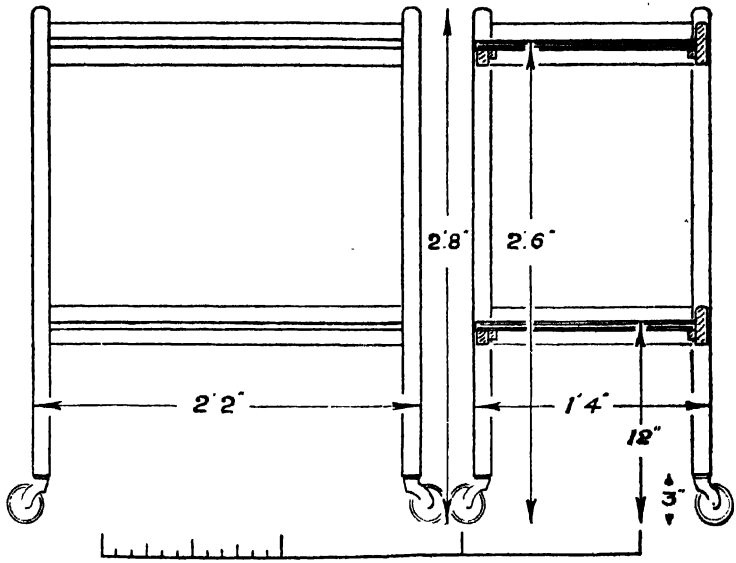


FIG. 16.—SCALE ELEVATION WITH SIZES.

CUTTING LIST

	Length.	Width.	Thickness.
4 Legs	2 ft. 5½ in.	1¼ in.	1¼ in.
2 Top end rails	1 „ 4 „	2¾ „	¾ „
1 „ back rail	2 „ 2 „	2¾ „	¾ „
2 Lower end rails	1 „ 4 „	2½ „	¾ „
1 „ back rail	2 „ 2 „	2½ „	¾ „
2 Front rails (below shelves)	2 „ 2 „	1 „	¾ „
4 Shelf fillets (ends)	1 „ 2 „	½ „	½ „
4 „ „ (back)	2 „ 0 „	½ „	½ „
2 Shelves (plywood)	2 „ 0 „	15 „	¼ „
2 Front edge lippings for shelf	2 „ 0 „	½ „	¼ „

Note that the length of leg allows for a rubber-tyred castor 3 in. high, excluding screw.

If the alternative method of fitting the shelves shown in Fig. 20 is preferred, the top rails are 2 in. by ¾ in. and the lower rails 1¾ in. by ⅞ in. No fillets are required in this case, the shelves being screwed to the rebated rails.

extra deep and to fix supporting fillets. In the other, Fig. 18, the rails are shallower, and are rebated to hold the shelves at the underside.

Prepare the legs first to finish 2 ft. 5 in. long by

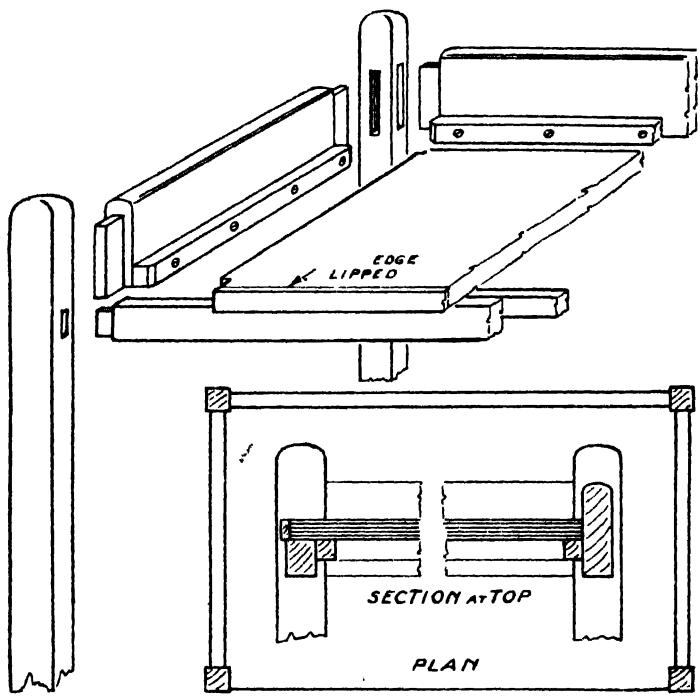


FIG. 17.—METHOD OF ASSEMBLY; ALSO PLAN AND SECTION.

1¼ in. square in section. Fix them together temporarily with a cramp and square across the positions of the rails. In this way all will be marked alike. Note that the tenons are set down at the top edges to form a shoulder. The mortises in the legs must obviously be set down correspondingly. Another

point to note is that the shelves rest upon the front rails. If it is decided to use the rebated method for fixing the shelves, the mortises must be set up underneath as well as on top, because the rebating automatically reduces the width of the tenons.

When the marking is completed, the legs can be

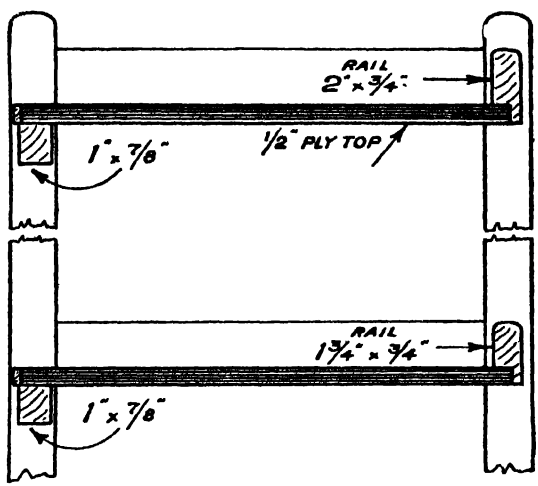


FIG. 18.—ALTERNATIVE METHOD OF FITTING SHELVES TO REBATED RAILS.

separated and the marks squared round on to the adjacent faces where required. The sides of the mortises are marked with the gauge. The section on mortise and tenon joints shows how the joints are cut. In the back legs the mortises will meet in the thickness of the legs.

Next proceed with the rails. After cleaning up they can be cramped together in two sets to enable the shoulders to be squared across. Afterwards the

marks are squared round each rail individually. Having cut all joints, they can be fitted and marks made on each, so that they can be replaced in the correct positions. When the whole has been tried together, the parts can be separated and cleaned up, The tops of the legs can be rounded also.

When glueing up, the two sides should be put together independently and the glue allowed to set before the remaining rails are added. If the rebated method of fixing the shelves is used, it will be necessary to add these when the front and back rails are put in. The corners have to be cut to fit round the legs. If they rest upon fillets, they can be added after the whole has been put together. Remember to lip the front edges. In both methods the shelves are secured by screwing from below.

The fixing of the castors depends on the particular type used. They generally have a special collar, which is recessed in a hole in the bottom of the leg and is tapped home.

It may be a platitude that to finish well is better than to start well, but it is absolutely true about woodwork. Look at that last thing you made and see if it isn't!

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